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CURATOR

A Quarterly Publication of The American Museum of Natural History

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Editorial Statement

This is the first issue of a new journal, entitled CURATOR. It is customary on such occasions to offer an explanation to the reader concerning the origin and the purpose of the new publication, beyond that which is implicit in the nature of the articles contained in the first issue. Such a statement is all the more appropriate in the present instance, since this journal represents a venture unique, we believe, in this country.

Although present museum problems, general and specific, probably confronted the very first museum ever established, they have, with time and the expansion of the museum's function, become vastly more varied and complex. The skill and competence now required to organize and administer a modern museum, to plan and prepare exhibits, to serve and deal with the public need for education and knowledge, to use and maintain collections, and to control the manifold interrelations of all these and other things as well, have taken on a highly professional character that reflects both the growing role of the museum in our culture and the high standards of performance that museums have taught the public to expect.

As a result of these developments and the steady pursuit of improvement, the varied kinds of dedicated workers who make up the personnel of a museum find themselves facing intricate problems, discovering elegant solutions, contributing to a specialized corpus of knowledge—and with no medium in this country through which to record their experience, to share their triumphs, or to seek the advice or criticism of their colleagues in other institutions. The day when standards were low and museums too few to present difficulties of communication is now past. Museum men and women have things to say and contributions to make to the common fund of museology in all its phases. These byproducts of dedication to museum techniques deserve the dignity and the value of a publication that will make them available to colleagues now too scattered and too numerous for informal or easy communication.

Recognizing the force of these reasons, the President, the Director and the Trustees of The American Museum of Natural History are undertaking to provide in these pages a vehicle for the expression of opinion.

comment, reflection, experience, criticism, and suggestion by the various members of its staff on all the activities of museum work. It is meant to serve the publication needs that fall outside its traditional scientific and popular publications. In short, this is to be a professional journal worthy of the skills and standards of modern museology. CURATOR will be issued as a quarterly and will be managed by an editorial board with full responsibilities for a policy, which, it is our expectation, will reflect the experience and the needs that time will reveal. Although CURATOR is being planned specifically to answer the growing need of expression by The American Museum of Natural History staff, the editors hope, as the journal develops, to open more of its pages to any article of general interest.

On Being a Curator

EDWIN H. COLBERT, CURATOR OF FOSSIL REPTILES AND AMPHIBIANS
THE AMERICAN MUSEUM OF NATURAL HISTORY

The curator in a natural history museum, particularly if he be located in one of the larger museums of this type, or in one of the university museums, is a person subjected to various forces from without and conflicting tensions from within. This is a result of the nature of his profession and of his training, for he is on the one hand a museum man, concerned with multitudinous museum problems, and on the other a practicing scientist, truly dedicated to some certain specialty in the broad field of natural history. In short, he is trying to do several things at once.

The conflicts have their basis in his training. The natural history curator in a large museum or in a university museum is almost invariably chosen because of his competence or his promise within his specialized field of knowledge. He has been through college, and after that through graduate school, to become proficient as a mammalogist or a coleopterist or a paleontologist, more often than not without any thought of ever being a museum man. Perhaps he has had some contact with museum methods and problems during his sojourn at the university, but unless he has worked as a student assistant in the university museum, that institution has been for him largely a place in which to study collections. Indeed, he may have had his training in a university that can hardly claim to possess a museum worthy of the name. Believe it or not, this is possible.

Consequently many men who serve on the scientific staffs of the large museums or of the university museums of natural history become museum men more as a matter of necessity than as a matter of natural inclination. Of course, this statement is not universally true; some natural history curators have had the idea of museum work in their minds from early undergraduate days. Nevertheless, a majority of such curators find themselves, after the completion of their Ph.D. work, on the staff of a museum, willy-nilly. Very commonly they go to some university to teach, and they find

that, along with their teaching, they are expected to help manage the collections in the university museum. Less frequently they go direct from the university to one of the larger natural history museums, where they may or may not be involved in a certain amount of teaching on the collegiate or graduate levels. In either case, they are chosen because they are experts in their particular subjects, rather than because they are museum men, and they enter into their new jobs for the primary purpose of research. For many such men the museum is incidental, just as it was in the days of graduate study; it houses the collections in which they are interested, and its function has for them little meaning other than as a place for the systematic storage of specimens and as a large institution with the proper physical facilities for research and with a good library.

Upon close analysis, it can be seen that the problem facing many natural history curators is a fourfold one, involving varied crosscurrents of conflicting interests. In the first place, the natural history curator has, as a specialist, a primary interest and responsibility in the field of his specialization. If he is doing research on mice or beetles or brachiopods, all other things are secondary to this work. Secondly, because of his interest and competence in such specialties, he more likely than not is expected to train students in his field; consequently he finds that as a second part of his professional life he is expected to give up a considerable amount of time to teaching and, what is even more exacting, to the supervision of graduate students working toward higher degrees. But he is, after all, a museum man, so he finds that he is faced with the necessity of looking after collections and keeping them in order. This is the problem of curating, pure and simple, the third part of the fourfold problem with which he is constantly confronted. Finally, he may have the fourth part of this complex of duties to wrestle with, namely, the problem of planning exhibits and supervising their installation. How is the curator to manage his life and his time among these several and in some ways quite separate duties?

Of course, he can try to give equal attention to all of the several phases of his work, but the more usual pattern is for the natural history curator to become "typed," as they say in the world of the stage and the motion picture industry. He may be the research type, or a combination of the research and teaching type, or he may be the curatorial type, which may be combined with the research type. Less frequently he may be the exhibition type, and if he follows this bent he may become strongly diverted from research and teaching. Then there are the rare fellows who really can carry off all these duties fairly successfully.

In many of the large museums and quite commonly in the university museums the research and teaching functions may crowd out the more

traditional museum activities. Indeed, in some of the largest museums the curator may be entirely a research man, who spends very little, if any, time on teaching, or curating, or exhibition work. Neither in function nor in interest does such a curator have much to do with that side of the museum which is most apparent to the outside observer, yet men like this are vital to the growth and the standing of a natural history museum. They are the authorities who, by basic research, build their scientific reputations, and concomitantly the scientific standing of the institution within which they labor. Let it be written in capital letters that this is an important fact all too frequently forgotten or perhaps never realized by the public and even by many trustees.

In natural history, as in other scientific disciplines, research is the only true basis for authority, and authority based on research is the lifeblood of a first-class natural history museum. Any natural history museum that finds it necessary to turn constantly elsewhere for help is not a first-class museum, because it lacks the voice of authority in its field, and consequently its program is either entirely, or to a considerable extent, derived from the efforts of scientists in other institutions. Therefore, the prosecution of original research by the members of the scientific staff is the first and by far the most important function of the large museum or the university museum of natural history. This must be done, even at the expense, if necessary, of crowding out good curating or good exhibition.

If this thesis be accepted, then it is the duty of the museum to see that the curator is able to carry on his research in an efficient manner. It is of little profit to the institution to attract a first-class scientist within its walls, and then to burden him with routine curatorial duties, administrative tasks, and the like, for by such practices the institution engulfs the individual and frustrates him, and both are the losers. Good curators need assistance, so if the museum wishes to fulfill its role properly it makes arrangements for scientific assistants, cataloguers, technicians, and secretaries to work with the curators, to do the many tasks that need doing and thereby to allow the curators time for their original studies.

The problem of teaching is not an easy one. In the university museum the curator was probably hired because of his competence in research, but he finds that the institution expects him to carry a teaching load, and, on the side, to serve as a curator in the museum. If such be the case, and if he has any regard for his research studies, the museum is bound to get very short shrift. There is barely enough time in the day to be a "full-time" teacher and a research worker—let alone to be a museum curator. Perhaps this is why the collections and exhibits in university museums are often in such execrable condition.

On the other hand, a certain amount of teaching is a good thing for

the natural history curator. Those curators in large museums who do no teaching tend to become very narrowly specialized; they know a lot about a restricted section of the world of nature, but all too often they have lost touch with the larger problems in their general field. There is nothing like a group of inquisitive graduate students to keep a man on his toes. Therefore, the ideal situation is one in which the natural history curator is able to do a certain amount of teaching, but not enough to burden him at the expense of his research and, perhaps, his most essential museum duties.

What about the curator as a curator? As the name implies, the curator was originally a person who took care of collections. He pulled drawers in and out of cabinets, put numbers on specimens, cleaned specimens, arranged them, and so on. He was a keeper—a title that is still applied to members of the scientific staff of the British Museum (Natural History). But in this modern world most museums have grown away from such a restricted concept of the curator and his duties. Most, but not all. Alas! Some university museums do hire "curators" whom they distinguish from the faculty, not only by titles and duties, but also by appreciably lower salaries. This is a practice to be condemned by all who are vitally interested in the progress and the standing of our natural history museums.

So it is that the curator in a modern natural history museum may be quite paradoxically (or so it seems at first glance) a person who does little actual curating. This is as it should be. The curator should have full responsibility for the collections in his field, not only for their care but also for the manner in which they should be augmented. He should also be in the position of directing the routine curatorial work on these collections, leaving the details to someone working under his supervision. With such an arrangement, the curator should be able to see that the collections are kept in proper order, without the necessity of giving up a large portion if not all of his research time for this duty.

Finally, what about the curator as an exhibitor? This is in many respects the toughest problem among the four that constitute the sum of a natural history curator's life. As mentioned above, many natural history curators enter upon their jobs with no training and perhaps not much sympathy for museum work. Frequently these curators are forced into exhibition work by the drift of circumstances, and they may take to it, or they may not. Of course, curators who come to the museum with a background of work in a university museum very likely are inclined to be interested in exhibition, and quite willing to give some of their time to the work.

Whether the curator does exhibition work of necessity or through choice, it is important that he participate in this phase of the museum's activity if the museum is to have authoritative exhibits. This is where the

curator's research pays off, so far as the museum administration and the public are concerned. The curator who is an authority in his field can see that the contents of the exhibits under his supervision are so accurate as to be virtually beyond reproach. He can give to the exhibits the authority that they need, and this should be his proper function.

The natural history curator should be a supervisor of exhibits, leaving the technical details to others, if such is possible. This is where much of the trouble begins. In a large museum an exhibition staff should work in close conjunction with the curator, and when the work is carried out in the spirit of true cooperation the exhibits will be first-rate. But all too often the curator and the chief of exhibition may not see eye to eye. The curator may lack artistic feeling and wish to clutter the exhibits; the man in charge of the exhibits may consider the curator "old hat," justifiably or otherwise, and want to introduce startling effects in the display, sometimes a little too startling for scientific integrity. Consequently, there is a good deal of pulling and hauling, and only by the exercise of careful compromise can the exhibition program be carried out successfully.

The sad part of this aspect of the curator's life is that exhibition work can overwhelm him. Exhibits may take a very large fraction of his time in a large museum when a new hall is being arranged, but after that, for compensation, he should for a considerable time be entirely free from exhibition problems in order that he may catch up on his neglected research. It is in the university museum where the problem is apt to be aggravated. Such a museum may lack the necessary technical help for proper exhibition work, and thus the curator may find himself trying to do the details for which he is not fitted, either mentally or manually. It is a sheer waste of time, money, and talent when the curator or the professor-curator in a university museum spends part of his days in tacking specimens to the wall of an exhibition case or sticking up labels, yet this very thing does take place.

Where does this discussion bring us? It brings us to the realization of the fact (if this has not already been realized) that a first-class curator in a first-class natural history museum is a man of several parts. He is primarily a research scientist, but he may be a teacher as well. He is a curator, too, and he may be something of an exhibitor. His problem is how to fit all these activities within the compass of his available time. It is impossible for him to try to engage in all four aspects of his work in an equal way; if he tries he will become a completely frustrated individual. Therefore, certain facets of his work must of necessity be emphasized at the expense of some of his other duties.

Through active research he builds his reputation in the field of science and along with it the standing of the museum. This gives him the right to speak with authority, and from this right his other functions in the

museum follow as a matter of consequence. This being so, it is then the responsibility of the institution to utilize the talents of the curator in the most advantageous manner possible. Conversely, it is also the responsibility of the curator to make use of his own time in a proper way.

When there are a lot of specimens to be taken care of, or a hall to be put in order, or students demanding attention, it is easy to drift away from research. Or once immersed in research, it is tempting to let collections and exhibits go hang. The secret is that of being the well-balanced man. In this day it is not easy to be the well-balanced individual, but with effort on the part of the curator, and with a certain amount of understanding and cooperation on the part of the institution, this happy state of being can be approached, if not completely attained.

Policies and Salaries for Museum Faculties

A. E. PARR, DIRECTOR, THE AMERICAN MUSEUM OF NATURAL HISTORY

The staff of a large museum includes people of so many diverse skills and professions that it is beyond possibility to devise a single system of salary schedules and employment policies that will fit them all. Each occupation must be analyzed separately, its value to the museum appraised, and its circumstances in the museum compared with those prevailing elsewhere. In this discussion we are concerned with that group of museum personnel to which we might apply the term "faculty" by borrowing from the terminology of other educational institutions.

The members of the museum faculty are those who occupy positions for which the museum demands an educational background equal to, if not identical with, the requirements of the teaching profession, and in which they perform or supervise activities directly aimed at educational goals. Curator, docent, and instructor are among titles commonly used within the faculty. And, happily, directors can also, as a rule, qualify as members of the museum faculty.

That the museums offer wider latitude than other educational institutions for the acceptance of practical experience and self-taught knowledge in lieu of qualifications gained through formal training should not confuse us at this point. In the situation that has nearly always confronted the museum profession we can scarcely afford to be confused by minor details.

The chaotic lack of standards for the employment of museum faculty has been common and discouraging knowledge in the profession for a long time. It has recently been clearly documented through the very useful studies undertaken by Dr. Carl Guthe, who has particularly concerned himself with museums of small and medium size.

Perhaps one of the most fundamental sources of confusion may be found in a general tendency to treat the word "museum" as if it were a specific term, and not merely a generic designation, as loosely defined,

both horizontally and vertically, as the words "educational system."

The horizontal subdivision of our institutions into museums of art, history, science, and other subjects is, of course, too obvious to need elaboration. But there is a natural reluctance among us to acknowledge that we must also recognize a vertical classification corresponding to the elementary, secondary, and advanced levels of the educational system, if we are ever to find a rational basis for the creation of professional standards that the rest of the world will accept and support.

A left-handed recognition of the need for a vertical classification may be seen in the creation of separate museums for children. But most museums remain in a general, unclassified status.

The classification of our schools is made easy by the fact that each as a rule serves only one particular level of education—elementary, junior high, high, college, and so on. The categories are in a large measure mutually exclusive. This is not true of museums. Whatever other levels of education a museum open to the general public may serve, it will always continue to include in its audience children from pre-school age and up, and adults with all kinds of educational background, or lack of it.

The classification of a general museum, and of its faculty, can therefore not be based upon *the* level, but must be related to the *highest* educational level to which it addresses a *significant* part of its efforts by deliberate and expressly stated intent.

The highest educational level that a museum may realistically claim to serve is, of course, in part a function of its size, but the size relationship may be substantially modified by specialization in certain fields. It is also a function of the size and character of the community of which the museum is a part. For instance, it might be difficult to argue that a community which does not support or contain academic institutions of higher learning should grant university classification to the museum and to the museum faculty. Only in the case of museum specialization in a subject of a particular importance to the local community could such a claim be made without appearing illogical.

It must be clearly understood that this is not a plea for a classification of museums by any organization or agency acting outside the particular institution and community concerned in each case. Such a course would, in the writer's opinion, be quite disastrous. Each museum must prepare its own brief and present its own claims to its own community and its own supporters. A national organization might give moral support to reasonable claims, and thereby exert a beneficent influence, but could only do harm to the cause of all museums by independent initiative.

The establishment of a single set of faculty standards for all museums is obviously neither possible nor desirable. In the welter of confusion of unclassified museums, any comparisons that might be made among sister

institutions are not only perplexing and inconclusive, but also are actually likely to be dangerously misleading, particularly for the administrators of the larger museums.

If, on the other hand, each museum establishes its own classification in relation to the divisions of the educational system, it will immediately find standards for faculty employment ready at hand in its own community. I venture to predict that nearly all museum faculties would gain by the application of the standards of the educational system to which they could properly lay claim by the correct classification of their own institution. How this principle has worked in our own museum may serve as an illustration.

In its most advanced educational services, including exhibition, The American Museum of Natural History operates on the level of the graduate schools of our leading universities, and a very substantial part of the Museum's efforts is involved in these activities. Our Museum as a whole must therefore be classified as an institute of higher learning. But this in no way reduces our responsibility towards the children; rather does it increase our moral obligation. Our educational spread is such that it would not be reasonable or efficient to expect the same personnel to be equally qualified to serve on all its levels.

In The American Museum of Natural History we therefore maintain two separate and distinct faculties, each with its own standards and requirements. Our efforts in elementary and secondary education are in the hands of a faculty of instructors placed in a large, separate department. Teaching at graduate school and advanced college levels is provided by the curators of our scientific departments, along with the supervision of the educational contents of an exhibition program conducted on such a large scale that it requires, for its proper execution, the kind of knowledge available only to research scientists.

For the faculty of our Department of Public Instruction we have been seeking to obtain the standards set in the secondary schools of the public school system of New York. Since the salaries of the instructors have always been largely, and are now exclusively, paid by the City, action has not depended upon ourselves alone, and we are only now beginning to approach our goal. If the immediate results do not satisfy all expectations there are good hopes of progress, and the dissatisfaction is not specific to the Museum.

On the other hand, the curatorial salaries have, for more than half a century, been paid entirely from private funds, in the complete control of the Museum's own authorities. It was therefore possible, already in 1944, to introduce the policy that the standards of professorships in the leading eastern institutions of higher learning were to apply to curatorships in The American Museum of Natural History. This policy remains

in effect today, its application in the Museum having kept full pace with the advances of professional circumstances made in our best universities.

This is not a policy of generosity, but only one taking realistic account of the fact that the museum and the universities are, more often than not, competing for identical qualifications and, indeed, for the services of the identical person, as we have many examples to prove. If the qualifications sought are sometimes not entirely identical, they are always completely equivalent.

It is, of course, a necessary part of such a policy that a candidate for a curatorial position must be able to meet the requirements on which the standards taken from the university world are based. In our Museum this aspect of the policy is watched over by a committee on promotions and new appointments consisting of members of the curatorial faculty appointed by the chairmen of all curatorial departments meeting as a body (Council). While its functions are purely advisory, the committee has certainly shown no lack of firmness in its task, and it would be an unwise administrator who, without special and excellent cause, went against the committee's advice.

It has occasionally been said that the curatorial standards differ from the professorial standards in regard to length of vacations (two months for full curators) and with reference to the "sabbatical year." But the university professor's need for the sabbatical year springs largely from the severe restriction of his geographical whereabouts imposed by the fact that he must be physically present on campus at frequent and stated times to give courses and lectures on a regular schedule. The curator's tasks, by way of contrast, may take him to the other side of the world as often as they keep him on the spot, and. if the advantage of seclusion is needed to set down in writing the results of his researches and explorations, this can also be counted as a legitimate aspect of his appointed duties. Under a sensible administration, longer vacations and sabbatical years for the curatorial faculty would merely add empty redundancies to the expression of policy.

But the situation of the museum curator differs from that of a university professor on one important point that must be taken fully into account in the formulation of museum policy. When a young scientist enters the service of a museum operating on the university level, the entire university field, as well as that of the museums, is open to him for his career. In some subjects, and for many curators, both fields continue to offer him their choice. But for many the tasks of the museum unavoidably lead into such subjects, or such specialization, that the opportunities to choose diminish with the development of the curator's qualifications for his job. To turn to the curator's disadvantage the qualifications he acquires for the advantage of the museum would obviously be highly reprehensible.

If promotions through the curatorial grades must wait for vacancies in the higher ranks, the museum is almost certain to find itself in the position of having to offer the opportunities for advancement that do occur chiefly to those who, by choice or circumstances, have retained the widest market for their services. Intrinsic merit ceases to be the only basis for material reward in the curator's career, and those whose devotion to their work has been greatest are quite likely to be the ones who will find their progress most severely handicapped under such a system.

To avoid any danger of such discouraging injustices, as well as the generally obnoxious "waiting for the funeral," each position on the curatorial faculty of The American Museum of Natural History is treated as basically equal to, and independent of, all others. The rank it carries in each case at any given time merely denotes the length of service and the achievements already attained by the faculty member. Increases in pay, on satisfactory performance, follow a regular pattern, and promotions in rank are automatically brought up for consideration at stated times in the career, if no action has been taken sooner.

Curatorial positions pass through three grades: Assistant, Associate, and Full Curator. These are treated on a basis of equality with the corresponding professorial ranks, with the exception that the grade of Assistant Curator embraces both the instructor's and the assistant professor's levels at a university. The salary of a full curatorship at The American Museum of Natural History, like that of a full professorship at comparable universities, now begins at ten thousand dollars per year.

KARL PATTERSON SCHMIDT

Karl Patterson Schmidt died on September 26, 1957, after having been bitten by a boomslang, a poisonous snake from Africa, that he was studying at the Chicago Natural History Museum. It so happens that the manuscript of his article printed in this initial number of CURATOR was received on that same day. It will certainly be one of the last contributions to come from the pen of Dr. Schmidt, and we are proud to have it in our journal. We had hoped that Dr. Schmidt would be a frequent contributor to CURATOR.

Karl Patterson Schmidt was a leader in the natural history museum field. He began his career in the Department of Herpetology at The American Museum of Natural History, but in 1922 he went to the Chicago Museum (then the Field Museum of Natural History) where he remained for the rest of his life. He rose to the eminent position of Chief Curator of Zoology, and in this capacity he exerted his beneficent influence over the Chicago Museum program in zoology for many years. He was an outstanding herpetologist of world-wide fame, and was the recipient of many honors, including election to the National Academy of Sciences of the United States.

Although amphibians and reptiles were his first love, Dr. Schmidt ("K. P." to his many close friends) was very much concerned with all phases of museum work. Indeed, he was one of those rare personages in this modern world—a first-class scientist and at the same time a first-class museum man. He devoted much thought and effort to the many aspects of the museum in which he worked—to research, of course, and in addition to the educational values of the institution, to problems of exhibition, storage, administration. Much of the excellence of the Chicago Natural History Museum today is due to the work of Karl Patterson Schmidt.

K. P. was a wonderful man to be acquainted with. He was a man of the greatest integrity, a man who always maintained high standards in his profession and in his daily life. He was a very kind and sympathetic person, and it was a joy to be in his company. He was always ready with sage advice for his colleagues, and to the younger men in his profession and in the museum field he was a wise counsellor with an enormous background of learning and experience which could be used for the benefit of those who came to him.

In truth, K. P. was quite a man. His passing is a great loss, not only to the Chicago Museum but to natural history museums all over America and throughout the western world. We take this sad occasion to bid farewell to a fine scientist and a leader in the museum world. His name and his works will be long remembered.

E. H. C.

The Nature of the Natural History Museum

KARL P. SCHMIDT, LATE CURATOR OF ZOOLOGY EMERITUS
CHICAGO NATURAL HISTORY MUSEUM

I

The larger public museums of natural history[1] are so protean in actual development and in their potentialities, that it is difficult to discuss the unique cultural phenomenon they represent within any reasonable limits. They are, on the one hand, educational institutions with an important mission—that of complementing, rather than merely supplementing, the whole of the academic system. Their contribution to education is a major one, for they represent, in fields of knowledge very different from those in which laboratories perform this function, a refuge from books, offering in their exhibition cases and in their collections of specimens the opportunity to return to the realities of nature, and to subject book-knowledge to ever-renewed test. Museums may appropriately cite the fable of Antaeus, that adversary of Hercules, whose strength was doubled whenever he touched the earth, since Gaea (the earth) was his mother. This contact with nature seems admirable and essential to the museum-minded professionals, who devote themselves to the service of the museum idea, and seems to be widely sensed also by the museum-minded public, who crowd the museum halls day in and day out. To us it seems unthinkable to educate from books alone, without recourse to real objects from the three "kingdoms" of nature, animal, plant, and mineral, together with those provided by the study of man—a fourth "kingdom." It is such collections that form the nucleus of every museum of natural history.

Without any rigid limitation, the museum of natural history is concerned primarily with the descriptive aspects of biology (systematics, animal and

[1] The phrase "natural history" is a relic of an era a century past, when it was in common use, to refer to much of science; with the vast development of all the sciences into more formally defined disciplines, "natural history," and with it the term "naturalist," have become almost without definition, or best defined by their use in relation to the function of the museum of natural history.

plant distribution, morphology, evolution, and ecology) and equally with the descriptive segments of the sciences of geology and anthropology. The museum field is thereby fundamentally different from that of the physical sciences. Chemistry and physics are so much identified in the popular mind with Science (Science with a capital S) that the basic distinction of the evolutionary sciences is lost sight of. A chemist is likely to think of the description of a new species of butterfly as comparable with the determination of the properties of some new hydrocarbon of a series of which many are already known. The difference between butterfly and hydrocarbon is vast. Allegorically, it may be thought of as the difference between the handiwork of God and that of man. The butterfly species is the product of a half billion years of evolution, of an irreversible history, during which it has become what it is by an inconceivably complex interaction between an organism and an independently changing and evolving environment. That the museum sciences must take account of the historical aspect is their most essential feature. It is this that largely removes their sphere from the fields of applied science and technology, and places the museum studies essentially as pure science, whose greatest importance is to advance man's understanding of his place in nature. The historical aspect also differentiates the museum researches in biology and geology from the work of the university laboratory, notwithstanding the welcome interaction between the university and museum fields.

The accumulation of collections, their orderly classification, and their care are at the foundation of every kind of museum. The devising of methods of recording and of labeling, and of descriptive printed matter and guide-lecturing, which will make the collections effective in the service of education, constitutes a vast segment of the work of the public museum. The exhibition halls form an institute of visual education. The function of education, in a museum devoted to the natural sciences, proves, however, to be as much dependent on concomitant research as it is in a university. Fortunately, in the history of museum collections, researches based on specimens led to the accumulation of collections quite independent of any thought of an educational function. Thus the development of an institute for research within the museum framework was foreshadowed. Such institutes, engaged in the study of special collections, supply the essential distinction, though sometimes unknown to the public at large, of the larger museums. The research institute is devoted to the advancement of knowledge in the fields represented in the museum, and in their subordinate special fields as far as they can be staffed with the funds available.

Once the two sister institutes, the one for visual education, the other for research, are established, it is found that their interaction within the museum organization is in every way fruitful. The over-rigid separation

of the two institutes, a separation that may be welcome to the scientific staff, may involve much potential loss in each direction. The institute for visual education, to meet the demands made upon it by a city's schools, may require a very large staff of its own. Overlap of function and freedom of contact, even some interchange of staff and function, are important desiderata.

The very writing of labels discloses the gaps in the collections themselves and the blanks in our knowledge of the museum's "kingdoms." Even when the reports on all the collections in all the museums of the world are brought together in the museum library, we find ourselves at the beginning of the description of nature, instead of near the end. Thus the curator, charged with the care and study of a segment of the collections, is all too keenly aware of its deficiencies, and is challenged to improve and expand it and to improve and expand his own knowledge. It is the awareness of the deficiencies of the collections and of our available knowledge that stimulates us to engage in ever-renewed collecting and field studies, whether in our home environment or as participants in an ambitious expedition to some remote part of the globe.

II

Research leads to *communication* of its results in publication. The reputation in the learned world of the larger museums rests ultimately on their record of publication. The exchange of publications between museums forms the nuclei of their libraries, and the museum publications distributed to university and public libraries provide wide contacts. Publications on the one hand are of purely technical results of research written for other specialists; on the other they interpret both research and exhibition to a lay public in semipopular essays, handbooks, and leaflets. It is the nature of biological systematics, as of descriptive studies in general, that their published reports may retain usefulness over a long period of time without becoming obsolete. It is difficult for a professional biochemist or an atomic physicist to understand the respect commanded in museum circles by the catalogues of the British Museum collections, published during the nineteenth century.

The combination of education and research in universities is so familiar to the educated public that one might expect appreciation and acceptance of the combination of the two functions in a museum. For some reason, this is not the case. Perhaps because the exhibition halls are so impressive, museum curators find themselves constantly under the necessity of explaining and justifying even the existence of the research institute and its independent collections. Books, with their air of finality, contribute to the impression that the knowledge of natural history is "finished," or at least reasonably complete. The reverse is the case, for our expanding

knowledge discovers new deficiencies as it expands. The museum zoologists and botanists and paleontologists have the special responsibility of establishing and adjusting the classification of the species of animals and plants, in the course of which they are under the necessity of supplying names for these entities, and of constantly revising the resulting nomenclature. These latter duties form an extraordinary game, on an international level, with complicated rules and keen rivalry, in which systematists sometimes become absorbed to the detriment of their science. The technical nomenclature of plants and animals, with its long Latin names, often formed from Greek roots, so much impresses the non-specialist that its minor importance as the mere first step in establishing order and classification and record is too often not understood. In any case, zoological and botanical nomenclature have gravitated into the hands of the museum specialists as these have become more and more charged with the over-all duties of record.

Two institutes, to repeat and emphasize, are combined in the great modern museum of natural history. The institute for visual education using objects and models for public exhibition, and intimately allied with the school programs at all levels, is conspicuous. Behind closed doors and on floors not directly open to the public, the work of the contrasting research institute goes on, sometimes without much contact with exhibition, sometimes actively participating in it or even experimenting with it. Physically, both institutes are characterized by the possession of growing collections. In origin, the collections for exhibition and study were sometimes one and the same. The function of education is best served by a rigidly selected series serving as a conspectus of the classification, or otherwise simplifying the vast heterogeneity and complexity of nature. Study and research, on the other hand, may require every possible specimen, and will sooner or later require the whole range of detail of animal, plant, and mineral form.

The division of the collections into a selected and meaningful exhibition series, and a vastly greater reserve of study collections, became an imperative reform in natural history museums as they grew and their functions evolved. This principle of organization was introduced in the British Museum by its great director, Sir William Flower, whose regime extended from 1884 to 1898. The study collections or research collections may be hundreds or even thousands of times as extensive in numbers as the materials for exhibition, which, since they require glass cases and whole halls to make them accessible, may in their turn occupy a much larger share of the museum's total space. Compact storage of the research specimens is often accomplished by preparing them for their storage cases as they are collected.

The exhibition and research collections are often quite independent in

origin. The mounting of animals for display goes back to the idea of the "trophy of the chase." The accumulation of specimens for study may be the primary activity of a specialist who has no thought of any relation of museum study to public exhibition. Great private collections of study material grew up during an era of private collecting, and these have steadily gravitated into the storerooms of the larger museums. It seems preferable to follow British usage and to adopt the term "range" for such storage spaces for collections actively being studied.

III

The basic staff of the large museum accordingly consists of specialists who are "curators," or, as the English translate the word, "keepers," of the collections. These specialists, whether in the field of zoology, botany, geology, or anthropology, are saved in the museum atmosphere from the great peril of specialization, that of becoming over-specialized. The museum charges them with the control of both exhibition and research; and their activities connected with the preparation and labeling of exhibits bring them into contact with the whole range of museum personnel and with the public as well. Such control of exhibition remains effective even when the exhibition activities are placed in charge of a separate department. The interests of the curators, or at least their experience, are further broadened by the essentially museum-limited function of the preparation of syntheses of their fields of specialization, which requires the writing of leaflets and handbooks and general treatises. The reputation of the staff members for encyclopedic knowledge brings a somewhat burdensome service as an information bureau, to which questions are submitted. This function ranges from the trivial settlement of a tavern argument as to the relative strength of lion and tiger, to the serious needs of the press for authoritative information concerning news reports that bear upon questions in natural history.

The variety of studies and the great numbers of specimens in the collections in charge of the scientific staff, notably in botany and zoology, require a very considerable supporting group of curators, assistant curators, assistants, and a variety of technical help. In the past, such supporting staff has often been very inadequate, and a curator in charge of a division may of necessity mount his own plants and pin his own insects, or may wash the bottles for his own specimens if they are stored in alcohol. Because an important aspect of the curator's duties is acquaintance with the objects he studies in nature, which takes him away from the museum, a minimum organization of a division will be curator, assistant curator, and secretary-assistant. When feasible, the number of divisions (as in botany, insects, and in other invertebrates) should be multiplied. Alternatively, the division should be strengthened by supporting techni-

cal assistance, which need not be described here. It is especially significant to note that the most important element of the training for a museum curatorship is that gained within the museum itself, for most universities have failed to encourage any students at all to direct their studies into the museum field. An important resource for supporting personnel in museums is found in the amateurs who may become the most capable and the most loyal of further staff members. The background of the amateur may often lack specific elements of training and may not have the breadth of view demanded in systematic biology in the modern era, but every museum staff can point with pride to staff members who have come in as volunteer assistants and have somehow acquired all the necessary intellectual equipment, whether through college and university training or without it. The deficiencies of the amateur as a scientist are not insuperable. It is not always remembered that Charles Darwin was an "amateur" throughout his long career. It is invidious to remark that there is "always room at the top," without noting also that there are useful roles to be filled in the niches along the way.

The over-specialization of the museum systematist into a "closet-naturalist" has rarely been a reproach of American museum scientists, who have almost from the beginning been aware that their museum specimens are merely samples of the multiformity of nature, and that their collecting is a method of sampling. This fundamental attitude of mind was often lost sight of in the past, and museum specimens were studied as if they in themselves constituted the species to be described. It is a feature of our own generation of museum specialists that they have drawn into their descriptions the physiology, the environmental relations, and the behavior of animals; they have turned their attention not only to the differences between organisms, but to the meaning of the differences. This trend is a part of a rapprochement between departments of museums and those of universities that is breaking down the barriers between the two aspects of the great fields of science that are their common concern. As the first round of the "description of nature," an inventory of species, is largely completed for many of the principal groups of animals (though leaving a large "mopping-up" operation in the necessity for completing, revising, and improving descriptions), a renewed attack on the basic problem of the *process* of evolution becomes possible. This attack, for the museum investigator in the biological sciences, is focused especially on the problem of the adaptation of organisms to their environment, the basic problem that was envisaged a century ago in "The Origin of Species." The modern reinvestigation of the problems involved could not be undertaken until the science of genetics had reached a degree of maturity, for genetics was for generations contemptuous of museum work. The impact of the environment on heredity, and thus on evolution, having

become a concern of genetics, the data of systematics have moved into new significance. The work of a museum expedition may thus turn from the focus on collecting more and still more specimens to the accumulation of the data about the relations of the species of animals and plants to their environment; fewer specimens are documented with more and more information. A museum field party will now find a need for meteorological equipment; it will need to observe not only the conditions of the climates in which organisms live, but also the microclimates within their specific habitat niches. An examination of the newer outlook in systematic biology, in fact, would require an essay on these new directions of field investigation; perhaps with the renewed caution that *documentation with specimens* retains its essential role. After an illuminating experience in the tropical rain forest of Borneo, my colleague D. Dwight Davis writes:

> It is now recognized that living nature is so vast and complex that it cannot be studied, or even comprehended, in its entirety. Moreover, biological phenomena are not absolute, but vary within certain characteristic limits. We are therefore driven to using scientific sampling technics. A museum collection is no longer regarded as a collection of objects, but as a *sample* of a segment of nature brought into the laboratory for study. It is studied *as a sample*, by the same rigid statistical procedures as are used in, e.g., public opinion surveys.
>
> The scope of the sampled segments is limited; we cannot bring into the laboratory samples of all the factors making up a natural complex. But we hope our sampling is broad enough to give an insight into the *processes*, past and present, that produced and maintain the complex. Such understanding precedes intelligent control of a natural complex—otherwise man merely meddles.
>
> Modern tools have greatly increased the range of sampling available to the modern museum. Portable meteorological equipment for recording factors of the macro- and microclimate, still and motion picture cameras, color photography, tape recorders, X-ray equipment, etc., all provide data of a kind only recently available. Such data are just as truly "specimens" (i.e., samples) as are preserved animals or plants (Davis, unpublished ms).

IV

The scientific staff of the museum is the nucleus of a much larger essential personnel, remarkable for the variety of its duties and diversity of interests, and hence with a great diversity of origins and training. In a large museum an administrative staff with business experience is essential. Its control of financial operations is vital to the management of a budget that must be adapted to available funds.

A library of natural history is an intrinsic major department in a museum. As the library grows, a great segment of its growth being by exchange of publications, it becomes continuously in use in the service of both education and research, and this requires a library staff for its man-

agement and control—a staff of curators of the library. The chief librarian should be coordinate with the chief curators of the museum's major divisions. The library functions as a specialized library of natural history, reaching beyond the walls of the museum, in the service of research everywhere, and often with active loans to sister museums. Not everyone realizes how different the use of books may be in a museum from the familiar pattern of reading and note-taking in a public library. In a museum a book may be drawn out, taken to the table of a staff member or student, opened at the pertinent page, and then tested by reference to a specimen or a series of specimens drawn from the range and laid beside it. Corrections of and additions to the published literature of descriptive natural history are an essential aspect of museum studies. The great founder of museums, Louis Agassiz, is perhaps most famous for the dictum, "Study Nature, not books." This was no more than a "wise-crack," for Agassiz was himself the first bibliographer of zoology. He compiled a published list extending to four large volumes. The more correct statement is: "Study nature in the light of books, and books in the light of nature"; but this will never gain the currency of Agassiz' specious and erroneous advice.

In the service of exhibition, model-makers and taxidermists (also essentially model-makers), artists, and technicians are charged with the basic duties of preparation of exhibits and their installation in cases. This group may be organized into a department of preparation. Model-making *per se* becomes of greater and greater importance as the cases are filled with representations of animals and plants or other objects. A need arises to reduce the number of objects displayed and to put the remaining selection to more effective service in education. A whole renewed exhibition program arises as attention is focused on the questions "What is interesting and what is important about these animals (or plants, or fossils, or other materials)?" Models are then required. In the Chicago Natural History Museum, for example, mounted skins of the duckbill and the spiny anteater were in their case for fifty years, with a label stating that these mammals laid eggs instead of giving birth to living young. Only lately did we bethink ourselves to add models of the eggs! The structures and functions of animals and plants, to be explained, require models, often enlarged models. In zoology the skeletons of vertebrates, too often segregated in a special hall, need to be brought into relation with the mounted skins of animals to which they also belong, and the structure of which they illuminate.

There is a conspicuous modern trend to attempt, by means of thoughtful arrangement and labeling, to set forth abstract concepts and principles rather than merely to show objects, however intrinsically fine these may be. The principles that underlie the sciences need to be set forth to the

general public in conjunction with the illustrative specimens the museum may possess. It seems evident that this shift of emphasis from the particular to the general is a pervasive one, found or to be expected in all museums everywhere. Not all of the efforts in this direction have been successful, for much experiment and much testing of results is still essential. It is noteworthy that such exhibits demand far closer cooperation between the scientific and the educational staffs than did the "old-style," take it or leave it, exhibits. Efforts to transform exhibition halls in this direction are sometimes over-zealous, and there is danger that the museum baby may be thrown out with the bath. The fundamental need for a conspectus of the data on which the principles are based must not be forgotten.

When the museum building is a large one, its maintenance staff will require trained engineers, architects, and artisans who are scarcely short of being artists. Cases, whether in the open hall or built in permanently, must be thoughtfully designed, and require the highest level of cabinet work in their construction. Lighting problems in a museum become of vital importance. It should not be forgotten that the museum's reputation rests to a very important degree upon a high level of competence in "housekeeping," by its staff of janitors and guards.

Labels require printing, and their adjustment to their function requires much experiment. Most museums are accordingly driven to the maintenance of presses and printers to staff them, and very often the whole function of publication of the museum's contributions to knowledge, both popular and technical, is taken over by the "Museum Press," with a varied staff and with modern presses and other machinery.

Thus, a hierarchy in a museum ranges from administrative personnel, scientists and apprentice scientists, artists and artisans, educational staff and guide lecturers, engineers, mechanics, and carpenters, editors and printers, to janitors and guards. A complex personnel, if the museum is to be a great one, must function with an extraordinary degree of harmonious coordination. Most of the activities of a museum may be matched in a university.[1] But in a university, such activities are scattered through a multiplicity of buildings and over a wide area, and the level of organization found within the walls of a museum is unattainable. In fact, as a university colleague has remarked to me, it is the unique characteristic of a museum that it constitutes a special world of its own, a microcosm.

[1] Many universities, in fact, maintain museums, and some include a museum of natural history, but these are extremely different from the great public museum here under discussion.

Design Standards in Museum Exhibits

LOTHAR P. WITTEBORG, CHIEF OF EXHIBITION
THE AMERICAN MUSEUM OF NATURAL HISTORY

The primary purpose and function of a museum and its exhibits is to educate. To achieve this end at a natural history museum, exhibits should be planned in which actual life is illustrated and in which native skills and cultures are displayed. Nothing should be shown merely because it is ancient or has curiosity value. Specimens, reconstructions, and processes should be exhibited because they have the authentic power to open the visitor's eyes to the movement and meaning of the stream of life. The natural history museum should take elements from nature and from life itself along with the theories, concepts, and philosophies achieved through scientific research, and combine them all into a meaningful presentation which tells a story. Within this basic philosophy it is the job of the museum designer and exhibit specialist to arrange the material into an aesthetically pleasing exhibit.

Everyone is familiar with the neglected museum, with its badly lit, inadequately labeled, and jammed exhibition cases. Many museums were and still are being designed and their exhibits installed according to traditions established before our Industrial Revolution. These institutions are not fulfilling their basic obligation of educating the public which they serve. Museums should be an integral part of their communities so that they make a definite contribution to human happiness, social efficiency, and general knowledge. Only thus can they make their existence and their cost seem obviously worthwhile.

With its fund of scientific information and its purpose of exploring the unknown, the natural history museum bears a double function of education: to communicate recent findings to the specialized scientific fields and to explain in broad general terms the culmination of this research to the lay public. It is this last function with which the present paper is primarily concerned.

The present-day science museum is the outgrowth of the large private

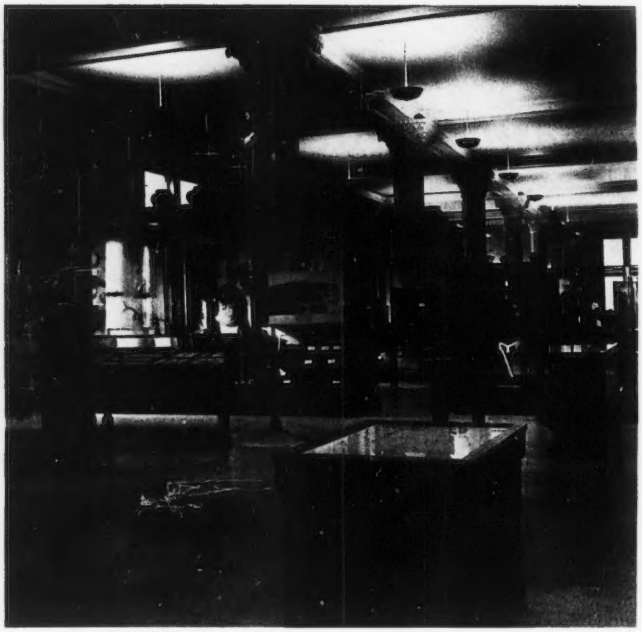
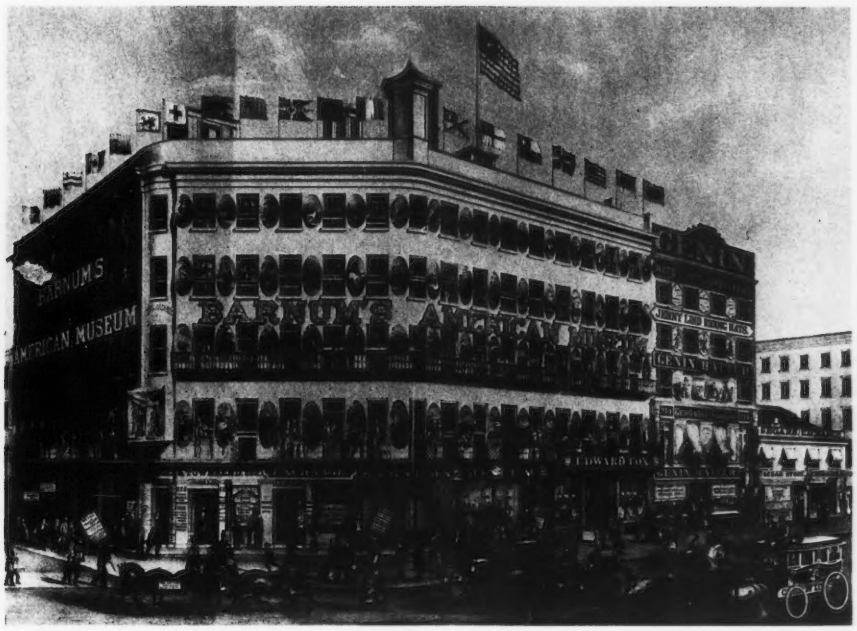


Fig. 1. Oddly assorted cases and obtrusive architectural features in the Hall of Southwestern American Indian Ethnography at the Museum are typical of the archaic left-overs still found in so many museums today.

Fig. 2. Barnum's American Museum in New York City, as it looked in 1851, showed curiosities for a price. Despite their side show atmosphere, commercial museums of this type influenced the subsequent development of true science museums by arousing interest in oddities in the fields of natural history.

collections of the eighteenth and nineteenth centuries, as well as of "commercial museums" of the 1830's. But large public museums, as we know them today, were scarcely thought of during that period. As Russell Lynes described them in "The Tastemakers," most museums then were commercial enterprises in which a few objects of art were shown "along with pigs with eight feet, Indian relics, mastodon bones, and other curiosities of nature, archaeology, and science. Though some of the museums had a basically serious purpose, almost any trick that would induce the public to part with a quarter for admission was worth trying."

The indiscriminate collecting of objects, with an emphasis on the curiosities, was the foundation of many of the world's large science museums. Dr. A. E. Parr describes their origin in the Eighty-Fourth Annual Report of The American Museum of Natural History: "The accumulation of ethnographic material in the 'curio cabinets' of European collectors has had a long and interesting history. By the sixteenth and seventeenth centuries such cabinets were already widespread in Europe. Some of them had become famous and even took on the character of museums. In addition to natural history specimens, they also contained an increasing accumulation of objects representative of the various cultures with which the expanding European culture came into contact. A little later, relics of



ancient civilization excavated from the ground also began to find their way to the collectors' cabinets, as archeology was born.

"By the end of the eighteenth century many public or quasi-public museums had already evolved from their origins in the curio cabinets, and the process of absorption of other private collections into the public museum had begun. In the early concept, the museum therefore functioned primarily as a repository for the preservation and display of rare and curious objects. In our own country, museums founded in the same traditions also began to appear before the dawn of the nineteenth century. A museum was established in Charleston, South Carolina, in 1777; another at Salem, Massachusetts, in 1779."

The repositories in which these early collections were housed were in the style of the public buildings of their time. In the 1800's the Gothic and classical elements of architecture, along with a tendency towards a rigid monumentality, dominated the general motif of interior decoration. In most instances, the architectural features overpowered the objects that were on display. In the midst of the heavy and overly-elaborate halls with their grandiose, cluttered display cases, it was impossible for the individual objects to command the viewers' undivided attention. This established tradition is now finally being changed.

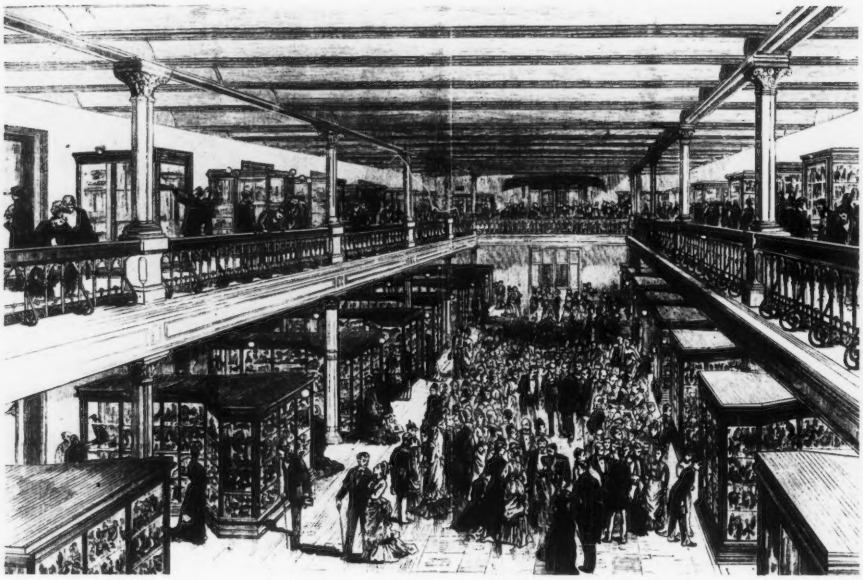


Fig. 3. Birds of the World Hall at the Museum had a spacious quality at its opening in 1877 in spite of its neo-classical architectural details and monumental exhibition cases.

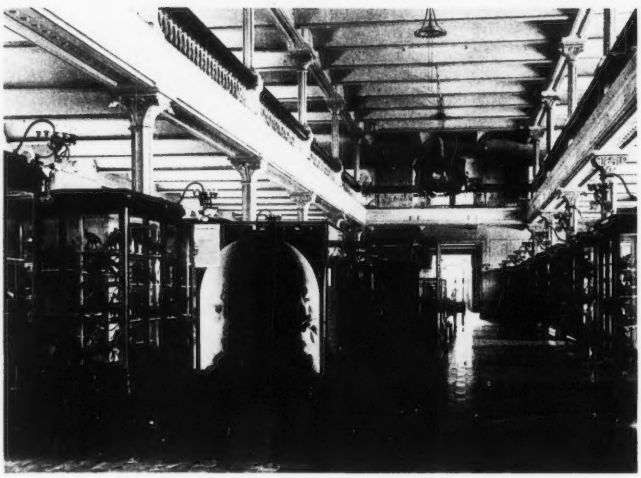


Fig. 4. Sixteen years later the Birds of the World Hall had lost its one redeeming feature of space with the addition of more exhibition cases down the center aisle and a hanging whale skeleton.

While "science" museums were being founded and establishing a tradition of exhibiting curiosities to a fickle public, the industrial and trade expositions that were developing simultaneously showed much more

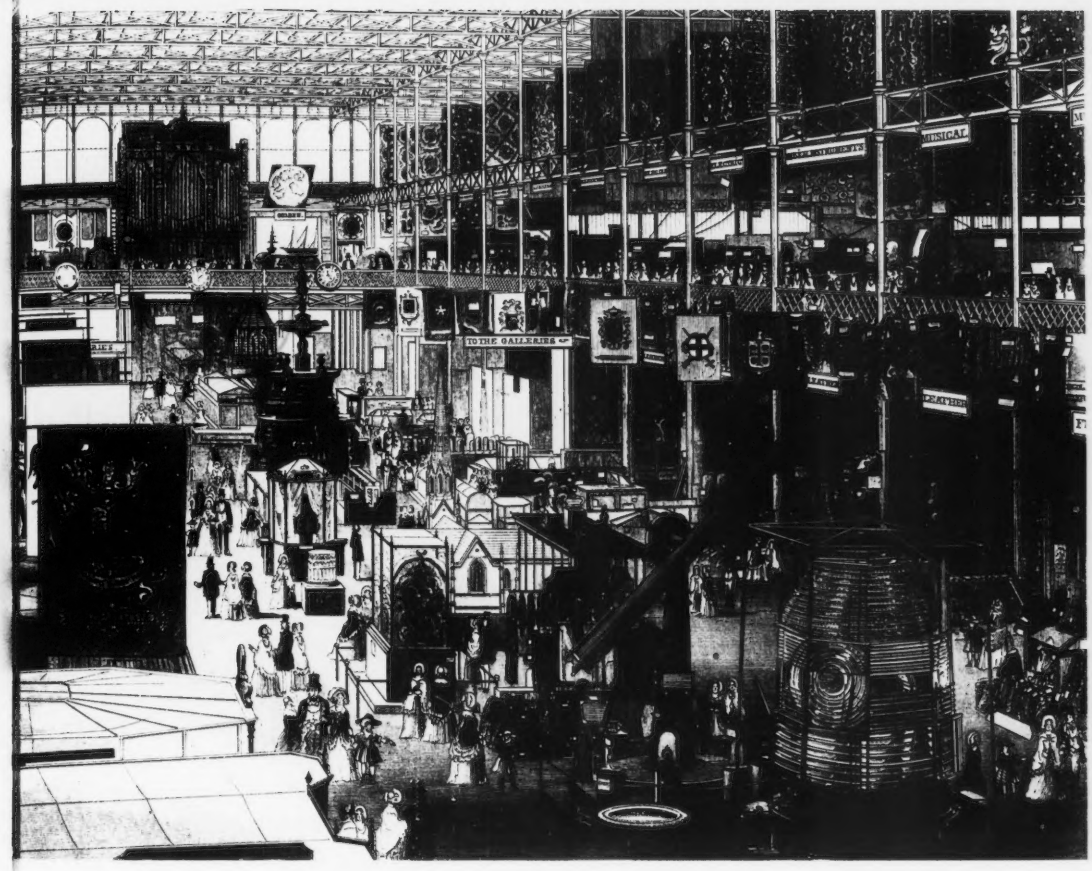


Fig. 5. The Main Avenue of the 1851 "Great Exhibition" in London's Crystal Palace became an inspiration for future architects, because it was among the first to utilize an uninterrupted span to enclose a vast exhibition space. The open work of the iron construction gave a feeling of lightness to the whole hall.

imagination in displaying their goods. The trade fairs had more spacious interiors and fewer items per square yard, and for this reason played a much greater role in the evolution of present trends of exhibition technique than did museums themselves.

The history and development of commercial exhibitions is a history of economics and of changes in our social structure, interwoven with technological advances. The change-over from manual to industrial production, the results of new production principles, and the steady rise in our standard of living, with the increase in consumer buying, brought about the necessity to advertise mass-produced articles in order to familiarize the public with them and to organize their sales on a national basis. The production rate of consumer goods in this new age of technology forced

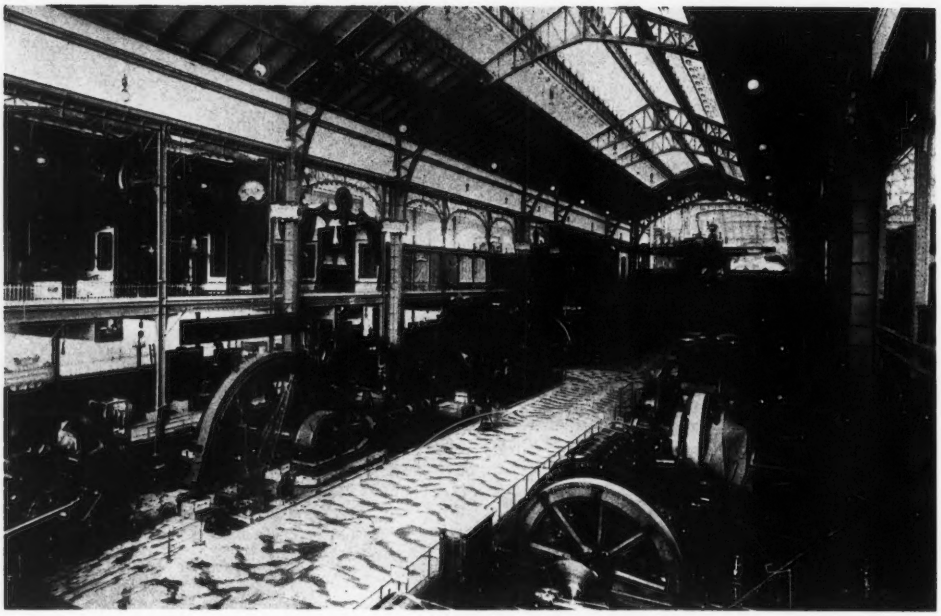


Fig. 6. The Machinery Hall of the 1900 Exposition Universelle in Paris incorporated simple bare structural elements in its quest for architectural freedom.

the manufacturers to use new methods in placing these items in the consumer's home. The recognition of the importance of exhibitions and fairs, as well as new package designs, as a means of public persuasion and communication, led to the use of the creative talents of architects and designers.

Around the middle of the nineteenth century there began the actual establishment of exhibitions as an instrument of industrial production. The exhibitions were a tangible expression of mass production and the new economy. Paris, Florence, London, Vienna, Philadelphia, Chicago, Glasgow, and St. Louis held international exhibitions in which nations began to adopt competitive exhibition methods. Today the international trade fair not only gives manufacturers a chance to show their wares in foreign countries to potential buyers, but also acts in a larger role in world politics as a propaganda instrument. The United States Government, Office of International Trade Fairs, Department of Commerce, participated in thirteen fairs in 1957, two of them in Iron Curtain countries, with impressive results.

While commercial exhibition philosophy was evolving along its gargantuan path, certain pioneer movements in the fine arts began that were to

influence modern exhibition techniques. Between the years 1890 and 1900 the realization and conception of architectural forms of the future originated with the artistic movements of the "Art Nouveau" in Europe and the "School of Chicago" in this country. In these schools of artistic expression the foundation stone of contemporary exhibition design was laid. The new movement broke with the past and experimented with new types of ornament and new types of material. But public opinion of that day demanded the florid style of a romantic-classicism as the criterion of all architectural form. With but a few examples of the "new philosophy" in evidence, the large world fairs remained the domain of historicism. By 1901 in Darmstadt, Germany (with the "Jugendstil," the German form of "Art Nouveau"), and by 1902 in Italy, the modern movement made itself felt in two important exhibitions. The Italian exhibition in Turin was the most influential, and launched the new style on an international level. The creative forces in these new schools manifested themselves mainly in interior decorations. Other exhibitions which furthered the new movement appeared in Dresden and Milan in 1905; Vienna, in 1908; and Brussels, in 1910.

The most important movement, on which much of today's interior and architectural expression is based, was the German *Werkbund*, started in 1907. It was a reaction against the artistic confusion of that day; it sought to bring the best architects, artists, and craftsmen together with trade and industry. It was Walter Gropius, the youngest member of the *Werkbund*, who, by founding the "Bauhaus School," really began the present synthesis of technology and art.

The modern art movements and their battles with tradition also played an important role in the new form of design and architecture. Painting and architecture both possessed the same mental attitude towards individualism, which opposed the classical academies and the academic artist. In Germany there were the Expressionists and the Dadaists; in Italy, Futurists; in Holland, De Stijl; and in France, the Post-Impressionists, Cubists, and Dadaists. These revolutionary movements, as well as a few others, presented a bewilderingly confused picture. They were, however, united in one aim, the fight against tradition, and each made an important contribution.

De Stijl contributed the feeling for structure in its most elemental form. The Dadaists set a standard for the coming form of graphic art by their mounting techniques and the projection of two-dimensional problems into space, as well as by the artistic treatment of objects of everyday use. Both of these movements, as well as others, set a pattern for the expansion of the new conception of form. The application of flexible moduli in modern architecture and exhibition technique was possible only by virtue of the pioneer work contributed by these modern artistic forces. The steady

Fig. 7. The 1953 retrospective exhibition of De Stijl at the Museum of Modern Art in New York City, typified its conscious use of structure through clean lines and the interaction of planes in the fields of architecture, painting, and interior decoration.

spread of the modern form of architecture and exhibition design over the entire world was facilitated by the expansion of industrialization and the spreading influence of the allied artistic movements.

The architectural forms that finally evolved from the progressive years of the 1920's were preoccupied with transparent, as distinguished from opaque, form. This development arose quite simply from the nature of the new materials that enabled the architects to build without walls and without ground floors. For in practice the new architects conceived their buildings in terms of steel girders in various conjunctions, revealing space between and around them. The essence of their structure, the functional skeleton, was not an arrangement of walls with holes pierced in them,

but a single transparent space punctuated by girders. The new skeleton architecture, which the Crystal Palace and the Eiffel Tower had heralded, now led them to think of space as an all-pervading factor within which forms of varied shape and density rise and meet and intersect one another in infinitely varied patterns. The architect was now free, for representational details or historic classical traditions were no longer necessary. As this new philosophy affected the external, the interior space became an uncluttered volume of space.

The realization that led the architect to utilize the basic mechanical structure in all its formal aspects as the prevailing visual force brought about a simplification in the exhibition structure. While the exhibiting technique of earlier days tended to place objects in a cluttered or a decorative frame, the new approach is one of placing objects in a simple installation where they are not in competition with the structural environment. This progress of exhibition design towards clean and simple shapes has led to a dramatic and more direct method of presentation. In addition to architectural influences, graphic design, painting, photography, and the applied arts and crafts made a strong impact upon exhibition design with their clean and simple shapes and careful use of color. In the combi-

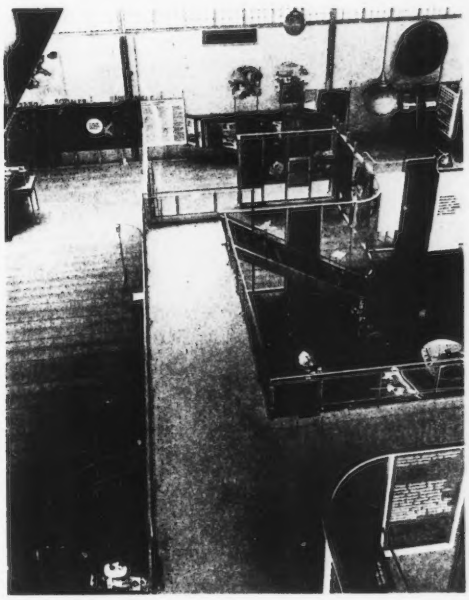


Fig. 8. The 1931 Building Union's Exhibition in Berlin which was designed by L. Moholy-Nagy, Herbert Bayer, and Walter Gropius combined the use of graphic arts, the new architecture and functional simplicity into a pleasing and meaningful display.

Fig. 9. Hall of Oil Geology, opened in 1954 at the Museum, employs good graphic design on simple panel elements. Old architectural features have been simplified, painted white to make them unobtrusive, and as in the case of the columns incorporated into the exhibit structure.

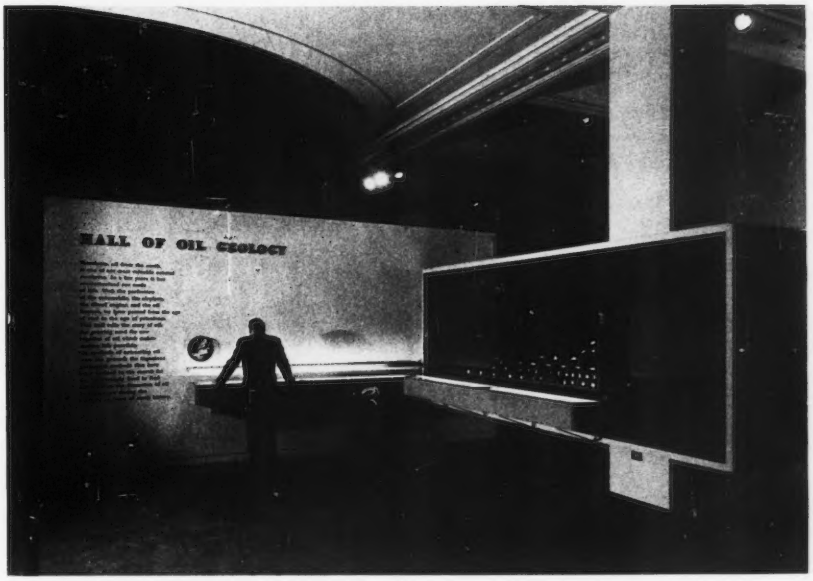
Fig. 10. In the same Hall of Oil Geology, a great freedom of space is achieved through the lightness of installation and the simplicity of the graphic techniques.

nation of simple use of structure with well-thought-out use of color, the designer has at his disposal one of the strongest of response-producing techniques. The careful use of color, form, and lighting can be used to lead the exhibition visitor along a predetermined path. Empty space can be utilized to afford the visitor a visual rest, a point that is extremely important in our larger museums. Color and dramatic lighting can be used to dramatize an important part in the story that is being told. In exhibition design, where the transmission of concepts and facts is the immediate and explicit purpose, ideas can be communicated by visual symbols, i.e., color and form, which act as substitutes for words and increase their effectiveness as meaning-carriers. It is, therefore, important in conceptual planning that structure, space, form, color, and light be dealt with together, not as unrelated elements.

It is the duty of the designer to free us from the fixations of tradition and symbolism usually associated with color and form by emphasizing the direct sensuous perceptional impact of color and form upon the spectator. The exhibition visitor should be made to feel that his trip to the museum was a spatial and visual experience in which the processes of learning came through an unconscious effort on his part.

The best works of contemporary exhibition design have aesthetic dignity, because they were designed by men of perception and taste who knew how to make an exhibit fit for its purpose and yet right for the eye. To achieve this end, the designer must be allowed to experiment by trial and error. This may seem extravagant and imply poor planning, but, on the contrary, it is a necessary ingredient of all major accomplishments, whether in science, music, or art.

The museum as a civic institution can learn from the dynamic techniques of the commercial display and incorporate into its own exhibitions the powerful use of color, lighting, and form achieved by high-impact advertising. While the museum operates on a long-range, slow-changing exhibition policy, the commercial exhibition is focused on a timely, temporary, and specialized function. Both philosophies have, however, one


HALL OF OIL GEOLOGY

EXPLORATION

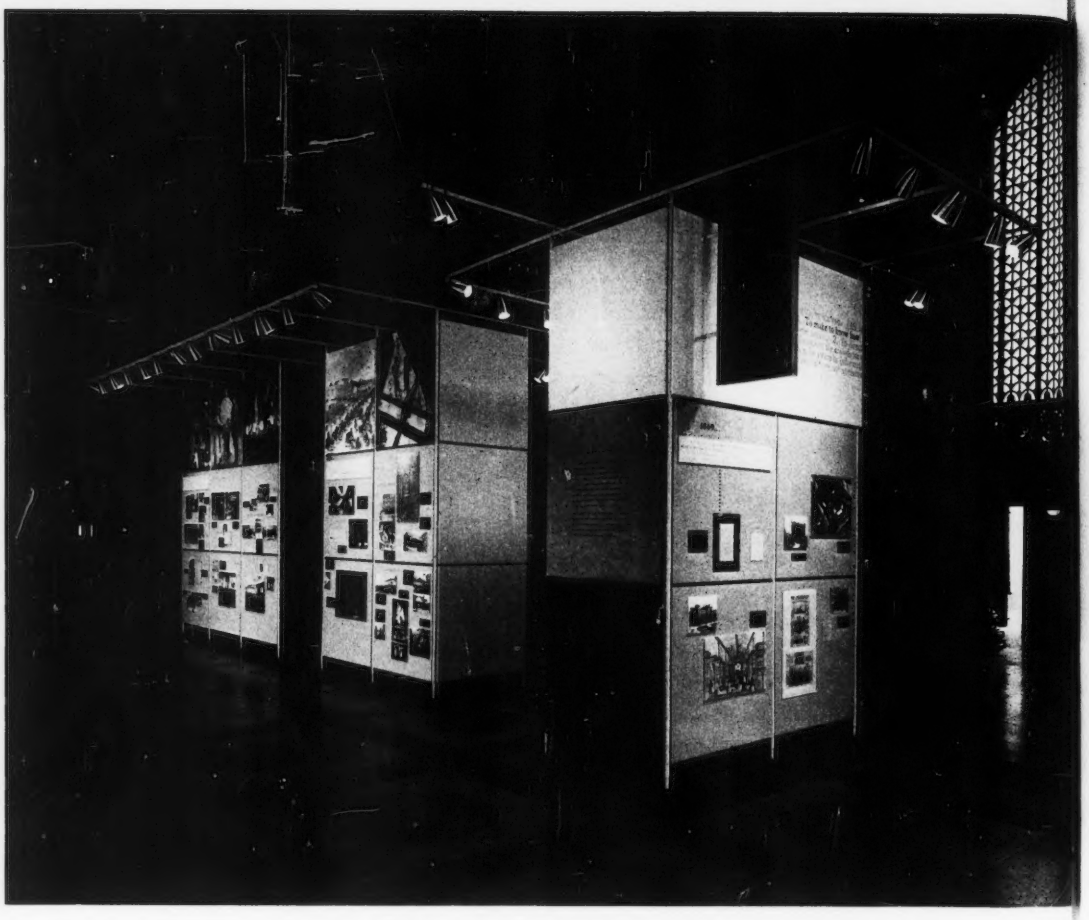
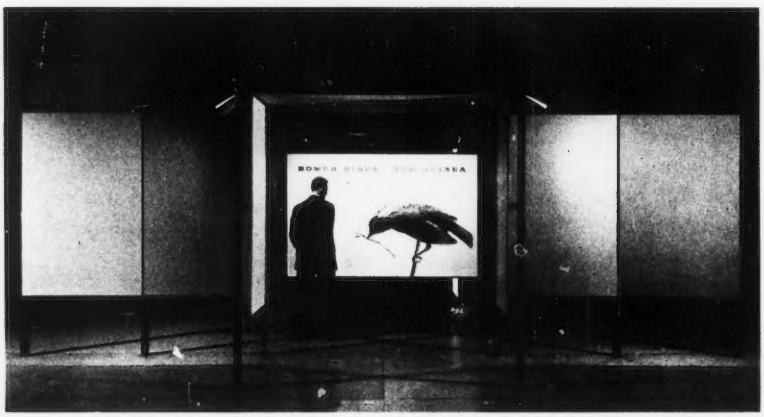


Fig. 11. A temporary exhibit installed in 1956 at the Museum illustrates the use of structural scaffolding with hanging panels. The modular units were quite compatible with the classical lines of the huge hall.



goal in common—stimulating public awareness. The museum communicates scientific facts, thought, and philosophy. The commercial exhibition shows industrial progress and new consumer goods with the ultimate aim of increasing sales. Present-day advertising has been highly successful in increasing the public awareness of products, in influencing ways of living, and in planting ideas and attitudes. It is therefore only logical that our museums should take advantage of advertising techniques, along with many of the methods developed by the commercial exhibition designer.

It is important not to lose sight of the main purpose of the natural history museum, the communication of scientific facts and philosophy by visual means. This purpose can be all the more successful if specific planning and design requirements are utilized to attract attention, to arouse interest, and, finally, to communicate information. The object on display is a physical thing apprehended by the eye. Its ultimate performance within the context of the exhibit depends upon the standards employed in its visual presentation. Too often the environment of today's museums is one of confusion and of such low design standards that the effectiveness of any individual exhibit, no matter how well conceived, may be defeated. The success of a display or exhibition, therefore, depends chiefly on the quality of its visual design. We thus see that the present-day designer of museum exhibits is faced with an exciting challenge—to improve the old and to invent new avenues of approach in visual communication.

BIBLIOGRAPHY

Bayer, Herbert, Walter Gropius, and Ise G. Gropius (ed.): *Bauhaus 1919–1928* Charles T. Branford Co. Boston. 1952

Gutmann, Robert, and Alexander Koch: *Ausstellungsstande.* Verlagsanstalt Alexander Koch GMBH. Stuttgart. 1954

Lohse, Richard: *Neue Ausstellungsgestaltung.* Verlag fur Architektur, Erlenbach-Zurich. 1953

Luckhurst, Kenneth W.: *The Story of Exhibitions.* The Studios Publications. London. 1951

Lynes, Russell: *The Tastemakers.* Harper & Brothers. 1955

Moholy-Nagy, L.: *Vision in Motion.* Paul Theobald. Chicago. 1947

Nelson, George (ed.): *Display.* Interiors Library No. 3, Whitney Publications. 1953

Parr, A. E.: *Filling the Gaps of Knowledge. Report of the Director.* Eighty-Fourth Annual Report. The American Museum of Natural History

Wilenski, R. H.: *The Modern Movement in Art.* Thomas Yoseloff Inc. New York. 1957

Fig. 12. A temporary bird exhibit opened in 1957 at the Museum created an intimate atmosphere for the cases inside by the use of flat plane construction and the integration of dramatic color and lighting.

The Challenge of Change

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Museums, like fashions in dress, have always either reflected their times or been a little behind them. Seldom, if ever, have they been ahead. When collections existed only in the castle of a king or baron, or in the mansion of an early industrialist, they were on view to guests and friends who happened in. When the French Revolution overthrew the monarchy, the palace of the king became a museum and the man on the street walked in, for the first time, to share with royalty the accumulations of wealth and good or bad taste.

The province of the present paper is not the historical growth of museums but the impact of modern technology on museums and the problems of the future in terms of the certainty of shorter work-hours in both industry and business, with the tremendous increase in leisure time that will result.

The history of invention is the history of museum improvement. When gas lighting became available, museums installed jets and globes and found them better than candles or closing at sunset. When central heating reappeared, after having been used by the Romans thousands of years ago, museums took advantage of this device, which permitted the public to visit in comfort even during the most bitter weather.

There are some basic technological developments that have made civilization what it is today, and museums have shared in these benefits. They include modern communication, transportation, the application of power to tools, and electronics.

The invention of printing ultimately resulted in a flood of reading material, a rise in literacy, and the growth of public and private education. These factors, together with radio and television, have provided museums with audiences more aware of, and more sensitive to, the museums' product.

Easy transportation brings the museums' visitors from all parts of the world. The nation is constantly on the go and so are museums, as evidenced by circulating collections and traveling exhibits.

With all the technological and educational improvements comes sociological change. Museums, contrary to the common belief that they are towered with ivory, have, for the most part, been in the market place. They have kept pace with both industrial and social revolutions and have grown with the machine age into the electronic age, adjusting creakingly at times, but adjusting nevertheless.

Museums adjusted to the twelve-hour day and the six-day week, both now long gone from the scene. Leisure time has increased, both in business and in industry. We are at the tail-end of the First Industrial Revolution, and these changes have occurred gradually within its framework. Labor-saving methods and labor-saving machinery—power tools, industrial reorganization, the comptometer, the business machine—merely represent the First Industrial Revolution brought up to date. But there is a Second Industrial Revolution emerging that will make the First seem like the period covering the time from the first stone axe to its first wooden handle—automation.

Automation is not merely simple mechanization. We have that now. When you put a tool-holder on a lathe you take the tool out of the workman's hand, but he still must adjust it, measure his work for accuracy, and apply the skills he learned after long, hard years of training. Automation is work done by an integrated power-driven mechanism entirely without direct human energy, control, intelligence, or skill. The judgment of the skilled craftsman has been eliminated in its operation.

To demonstrate what automation can do in industry, consider that fourteen glass-blowing machines, each operated by one worker, produce 90 per cent of the glass light bulbs used in the United States and 100 per cent of the radio and television tubes, with the exception of TV picture tubes. Fourteen men out of a population of 165,000,000, to make light bulbs and tubes! An engine block used to take 400 men forty minutes to make. Today the same block is made by forty-eight men in twenty minutes—in half the time and with one-eighth of the labor force.

Predictions for the future indicate that by the end of 1958 from 20 to 25 per cent of the metal-working processes in industry will be automated. Some industries can automate as high as 70 per cent of their operations.

How does automation apply to museums? The sociological changes that will come about are too complicated and too numerous to treat within the compass of this paper. But there are some basic conclusions that can be drawn for the museum world to worry about.

Social changes will be striking. There has been an industrial trend away from the large cities, and this will be even more pronounced as the

automated industry does not require a large labor force. Many large cities will lose their factories and become residential, and the people who moved to Suburbia to avoid smoke, congestion, and traffic will move back. Workers will continue to live on the periphery of out-of-town industries, and the dividing line between Suburbia and Urbia will be even less marked. With an increase in resident population, museums will have an even larger clientele.

The mechanization of the First Industrial Revolution proved repetitive enough for the workman who punched out the same metal part hour after hour, day after day. But automation means that he pushes a button and takes no action unless the machine goes wrong. The monotony of working repetitively with fellow workers has been replaced by the monotony of tending in solitude, to such an extent that a British labor union has asked for what it calls "lonesome" pay for workers on automated machines. Such work calls for stimulating outside activities for leisure time, and the planning and presenting of such activities will again be a museum function.

Automation is best used in continuous-process manufacture. Because its machines are so incredibly expensive, they cannot be allowed to remain idle, any more than a steel-producing furnace is allowed to cool off. Accordingly, automated industries must operate on a 'round-the-clock schedule. Working hours will become shorter and shorter, and we may expect to find six four-hour shifts a day or even eight three-hour daily shifts.

Working hours may also be spread so that people will have much more free time, at what are now considered "odd" hours except by printers, bakers, and milkmen. With both industry and business working 'round-the-clock, many people will prefer the night shifts in the office or factory. Psychologists tell us that some people do their best work at hours when others have been asleep for half the night, and business and industry may come to recognize the value of such people.

What it all boils down to is that we are going to have many millions of people, all over the country, with much more time on their hands than ever before and longer vacations than they have previously enjoyed. These people will be searching for outlets, for hobbies, for avocations—that will give them self-fulfillment—avocations that may become more important to them than their vocations. Museums will have to face up to the fact that much of the population will be free at almost every hour of the day or night.

In the future, museums will find themselves visited by people whose jobs permit them to be free for a goodly part of the day, and we must provide full-time adult programs for them. They will not be "one-shot" tourists, but "repeaters," if we meet their needs and desires. As for night

openings, museums have tried the hours from seven until ten to give people who work during the day a chance to benefit from their exhibits and programs. What do museums think of staying open twenty-four hours a day, with film showings at two, four, and five-thirty *in the morning,* with classes in "Painting for the Amateur" or "Science for the Layman" at midnight?

Fantastic? So was free education, radio, television, and the thirty-hour week. And some educational agencies are already thinking in terms of the future. The National Recreation Association, to quote Joseph Prendergast, its Executive Director, "agrees that the problem of the new leisure calls for a fresh concept of how to help people develop all their potential interests and capabilities. The true test of a democracy, after all, is what we do when no one tells us what to do." The Recreation Association is looking for support for pilot projects that will lead people to the fullest possible use of their leisure time.

Our museums are already heavily committed to adult education. Now we need to plan for the certainty of the changes that will come with automation. Then, with foreknowledge and awareness, we will find ourselves and our museums in a period of educational productivity that may well become the Golden Age of museums in America.

Primitive Art and Anthropology

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THE AMERICAN MUSEUM OF NATURAL HISTORY

Museums, at least in one respect, are like other institutions and organizations. If they are successful in filling a genuine need in the life of their community, they tend to expand and ramify their functions and services. This, of course, does not imply that they may not overexpand or overramify or that they may not help to stimulate the needs they supply. But in a general way, it is fair to say this kind of growth is symptomatic of an existing condition and that we can conclude from the enormous expansion and development of museums in this country that our culture and economy have reached a point where museums play a role that is real and valued. At any rate, it is comforting to us who have devoted our lives and thoughts to museum work to feel this is so.

We might, of course, expect that mere growth in size and population of the United States would, other things being equal, have encouraged an increase in the number of the museums of the country. But not only have our museums far exceeded a simple *pari passu* expansion with population; they have become far more complex in their functions and ramified in their specialization. Hardly an activity or a category of our culture lacks its museum to preserve and display its history, purpose, and achievements. No better illustrations of this tendency can be found than the excellent Farmers and Baseball museums at Cooperstown, the Corning Glass Museum, and the various village restorations. And just the other day I saw the announcement in the *New York Times* of a new museum for huntsmen to be established in New Hampshire. But along with the proliferation of new museums serving interests not previously or adequately provided for in older ones, we also see the expansion of coverage in our established institutions. Sometimes it represents the changing content of the knowledge and learning that lie behind museum exhibits, but

often it may reflect an actual expansion into new fields that changing attitudes and viewpoints may discover to be pertinent to the traditional ones.

All this might seem altogether right and desirable were it not for the fact that much of it is the result of uncoordinated effort, and the product of unplanned and possibly wasteful expansion. As museums expand and grow and as their numbers increase, their interests and coverage are bound to touch and perhaps overlap at specific points. Where this occurs within a community, it becomes reasonable to ask whether duplication is wise and whether limits between museums should be drawn.

As a case in point, so-called primitive art may serve. Since this field illustrates some of the general tendencies I have already mentioned, it may be instructive to retrace its history briefly. Fifty years ago, primitive art as a subject of wide recognition and appreciation did not exist, nor had it achieved the narrower distinction of an academic specialty. There were, of course, a few individuals who collected for their esthetic appeal specimens of what we would now call primitive art. But, on the whole, its only serious students were anthropologists who, in their studies of primitive cultures, recognized that the carvings and decorations they encountered were valid expressions of art even if that art followed canons quite different from those which governed our own expressions of the same impulses. Thus it came about in the normal collecting of material cultures and in the installation of exhibits intended to illustrate them that objects of considerable esthetic merit were included. Indeed, many curators consciously sought to choose pieces they regarded as especially meritorious. But these objects were rarely, if ever, segregated from their function or tradition and displayed as Art. Primitive art was still a terra incognita capable of providing a sense of personal discovery for the perceptive observer.

In part, this failure to display such specimens simply as expressions of esthetics must have stemmed from the fact that the societies that maintained and frequented museums were not then psychologically prepared to accept these "primitive" objects as genuine and serious manifestations of art. The disproportions of a Mexican god, the bizarre distortions of a Melanesian mask, or the abstract designs of an Australian aboriginal were regarded as monstrous or child-like and as the products of inadequate observation, of defective technique, or both. Even as recently as a couple of years ago, I heard a respectable art expert on a radio broadcast declare that one of the differences between primitive art and the fine arts of the civilized world lies in the absence of tradition in the former. Nothing could have been more mistaken, but it illustrates an attitude that was once common. It is, in fact, tradition that provides one of the keys in understanding primitive art. Thus, if here and there a curator all unwit-

tingly and through the slow education of familiarity came to recognize and value the beauty and integrity of primitive art, his public did not have that advantage and would have laughed at any attempt to dignify these apparently inept expressions of art by treating them with the special reverence then reserved for the art of the Western World and of the civilized nations of Asia, past and present.

It is now commonly asserted that the revolutionary change in our regard for primitive art arises from the recognition of its merit by Picasso and his contemporaries who, themselves evolving new approaches to art, were thus quick to see values previously overlooked by connoisseurs bemused by realism and technique. I suspect that this is too simple an explanation. At any event it ignores, if it matters very much, the role of the sensitive curators who had come to appreciate the principles and achievements of the various artistic traditions with which their concerns brought them into intimate contact.

By the twenties, dealers in Paris were already beginning to stock African and other native art for collectors. Here in New York we have also seen over the past twenty years an extraordinary development of auction sales, dealers, and collecting in this field. Since 1926, when I first joined The American Museum of Natural History, I have watched with interest, amazement, and sometimes dismay the sky-rocketing prices as a reflection of this growing interest. Pieces that once could find a market only in an anthropological museum at around five dollars I have seen sold at prices running into four figures and, even at such prices, finding eager buyers among private collectors and art museums.

I cite this all too familiar aspect of the world of dealers and collectors because it is one measure of the public interest in primitive art and a gauge of the growing appreciation of its intrinsic merit. Others might be found in the comfortable place that it has achieved in modern decor and its influence on mass-produced design and the minor arts.

With a public becoming awakened to primitive art and eager to see first-class examples of its kind, the museums began to dust off their finer pieces which were now acquiring the luster of treasures. The museums fortunate to be able to serve this interest initially were those that were anthropological in their interests or had departments devoted to the same field. They were able to do so because in any important and representative collection of anthropological artifacts there were bound to be some pieces of superlative merit rating inclusion in the new category of primitive art. And of course in the older and (in collections) richer museums of this kind the number of fine pieces was large and impressive.

The revolution in public taste had not only transmuted curious objects of little monetary value into rare and highly priced treasures, it also

brought about a recognition in exhibits and displays of a field that had previously been neglected or entirely omitted. Perhaps it would be more exact to say that this development in taste *permitted* curators to expand their activities into a field they were already coming to define as worthy of serious attention.

Now, it might be regarded as a natural and normal expansion of anthropological museums and exhibits that they assume the major responsibility for making the public familiar with primitive art. In the first place, they already possess the material for such a job and secondly, and more significantly, they could by virtue of training and collections present primitive art in relation to the culture of which it is an expression. This dependence of primitive art on its particular culture is an essential aspect of its very nature, and to sever them completely is to distort the nature of the art.

Things have not, however, followed such a course. For a variety of reasons too complex to analyze here, the world of dealers and collectors has exerted an influence that has worked toward the separation of primitive art from its setting. Primitive art has in many quarters been abstracted as a kind of pure esthetic expression or at least as capable of evoking esthetic reactions that have nothing to do with its creation. At the same time, fine art museums have been affected by all this relatively sudden burst of enthusiasm and many of them have invaded the field, acquiring examples for display in the traditional fine arts setting. This tendency to "elevate" primitive art has been resisted in some art museums, but enough of them have gone along to justify the present observations.

Here in New York the process of abstracting primitive art has reached its ultimate with the establishment of a special museum to house and exhibit it as fine art and without reference to the cultures that explain and define its existence. This has happened in a community where there already exist three museums with major anthropological collections and exhibits where fine examples are available to the public, and in two of which special emphasis is placed on primitive art in temporary as well as in some of the permanent installations. The question arises whether this is indeed an example of unnecessary and perhaps wasteful duplication. That it has come about through the cultivation of an interest from various directions does not justify duplication, if unnecessary, even though it may explain it. That this is not an isolated example is apparent from the increasing activity of the Chicago Art Institute in acquiring primitive art for display in a city where exceptionally fine collections already exist in the Chicago Natural History Museum.

I think it may be interesting to examine some of the pros and cons here for the light it may throw on this problem of museology. Obviously it is

a subject that lends itself to protracted discussion. And although I may err, therefore, in being fairly brief, I am limiting myself only to certain aspects of the question.

I suspect that one of the principal arguments for a "fine art" treatment of primitive art would be that this art is worthy of the elegant installation and of the emphasis on the object as such that usually surrounds the display of the fine arts. The skillful placing of a piece in space and in association with others, the subtle lighting to bring out aspects not readily visible, the use of color to enhance qualities in the piece, all tend to focus attention on it in a way that has become associated with fine arts treatment. If the object is a fine one, it should be deserving of the most advantageous presentation as an isolated work of art. This follows a tradition which is generally accepted as proper for conventional fine arts and which is rooted primarily in the display of Western art.

Now, I think a case might be made out that this divorce of art from its cultural origins is not altogether fortunate even for Western fine arts, but it is at least conceivable that the damage is not too serious in this instance. Western art, after all, is an expression of our own culture, and most reasonably educated people are already familiar with it through the countless ways that living in a culture such as ours provide. They are not, therefore, as innocent of knowledge of its milieu as they are when they see primitive art similarly exhibited. Not without bearing on this point is the fact that Western art, at least in its more recent aspects, is often designed to be displayed in a fine arts museum, the museum itself being a considerable force in the development of Western art.

Primitive art, on the contrary, is rather more like the religious painting of the Renaissance which was meant to be an integral part of the psychological and spiritual aura of the Church where it is still seen at its best. The primitive artist, moreover, works in a tradition and does not use his skill or art as a personal vehicle for the expression of his own emotions and reactions. He is subordinate to his culture and is never in revolt from it. Thus the isolation of primitive art from its source and inspiration can only fail to present the whole of it.

I don't know how significant the snobbery of museum attendance may be in this situation. Perhaps habit is a better word than snobbery. A few years ago we put on at The American Museum of Natural History an exhibit of primitive art that was advertised widely as such. We made special efforts to inform the art critics. Very few of them came. They were not accustomed to visit a natural history museum to see art. It is possible that the public is also conditioned in the same way and will look at primitive art only if given the red-carpet treatment of the fine art museum. If this is so, the fault lies with us in not re-educating the public. It can

scarcely be a sound reason for establishing museums to duplicate functions of existing ones because habit patterns demand it.

These, among others, are reasons that impel me to conclude that primitive art belongs with its culture and should be exhibited in reference to it. Such a task belongs in the anthropological field. The entrance of the art museum into this area constitutes an overlapping of function that is difficult to justify. When anthropological museums are already established, it is more economical to support and encourage them than to create new agencies. But more important, justice to the material itself demands the fullest opportunity to appreciate all its aspects. Anthropological exhibits can and should do this. Perhaps the anthropological museums will take note and really wake up to their full responsibilities.

A Philosophy for Planetarium Lectures

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More than a quarter of a century has passed since the first of the American planetariums opened its doors to the public. Some twenty-five million visitors have enjoyed lectures on astronomy and related subjects during that interval. Now, in 1958, there are major planetarium installations in Chicago, Philadelphia, Los Angeles, New York, Pittsburgh, Chapel Hill, and San Francisco. Three more—in Flint, Boston, and at the United States Air Force Academy—should be completed and opened to the public before the end of the calendar year. In addition, more than one hundred classroom-size units have been installed in colleges, museums, and even high schools, and are adding their influence to the field. Unquestionably, the planetarium is a significant force in the teaching of astronomy in this country. Or at least it should be! In spite of the ever-increasing number of installations, and the booming attendance, the writer senses the absence of clearly-defined purpose. How should a planetarium be utilized for greatest effectiveness? What are the objectives?

Perhaps the incorrect use of the word "planetarium" accounts for some initial confusion. If we adhere strictly to the definition, a planetarium is no more than a man-made mechanical device capable of recreating the skies with a good degree of accuracy as they might be seen from any place on earth at any time within a few thousand years. All those constructed to date—by Zeiss, Korkosz, the California Academy of Science, Spitz—are a tribute to the inventive ingenuity and imagination of their builders. They contain motors, lenses, gears, wheels, and lights interrelated in endless combination. The result is a device—a training aid—probably unequalled in effectiveness. The word "planetarium" has, in practice, come to mean much more, however. It is an institution that commands and usually receives the respect of the community in which it is located. It is

a center of information and technical authority in an age when such information is literally demanded by its constituents. And it is people, for no institution is greater than the men and women who cause it to flourish, and no device—not even a planetarium projector—is more nor less than the men behind the hands that gave it birth and flick its switches.

In order to place the planetarium as an astronomical institution in the proper perspective, it will be useful to review briefly some of the background which provided the atmosphere prevalent in this country in the 1930's when the first planetariums were built.

Many historians allude to astronomy as the oldest of the sciences. It must have had its origins when some ancient peoples looked into the heavens and attempted to explain the motions and appearances of the objects they saw. It is probable that the Mesopotamians who inhabited the plains between the Tigris and Euphrates rivers some forty centuries before Christ should be credited with this distinction. Following them, astronomy flourished among the Egyptians and the Indians, the Babylonians and the Jews, and in the far east among the Chinese. It came to full flower in the Greek school under Homer and Hesiod, later under Thales, Pythagoras, Plato, and Aristotle. During the regnant years of Alexandria, Hipparchus established himself as the greatest astronomer of antiquity; his work was brought to fruition three hundred years later by Claudius Ptolemy. It was the philosophical interpretation of Aristotle and the curiously adequate mathematical exposition of Ptolemy that combined to provide the concepts which penetrated the Roman and Medieval eras virtually unaltered to become the basis for astronomy as it was taught in colonial days in the United States.

In 1636, when Harvard was founded, only one hundred years had passed since the creators of the new astronomy—Kepler, Tycho Brahe and Copernicus—had set the stage for the destruction of the Ptolemaic explanation of the universe as a geocentric phenomenon. It was but twenty-six years after Galileo Galilei had directed a crude three-inch refracting telescope into the skies to discover the rings of Saturn, the four major satellites of Jupiter, the phases of Venus, the craters on the moon, and the spots on the sun. It was only three years after Galileo's ecclesiastical trial and the forced recanting of his beliefs. Uranus was to remain unknown for another one hundred and fifty years; Neptune and Pluto were little more than mythological characters. Isaac Newton and his physical laws of motion and gravitation were still unborn.

The astronomy stacks in the library of The American Museum of Natural History contain a wealth of old volumes. Among them is a badly deteriorated copy of the *fifth* edition of Elijah H. Burritt's "Geography of the Heavens." It appears to reflect the "natural philosophy" attitude that

was prevalent in the teaching of astronomy in colonial times, and apparently well into the nineteenth century. Burritt[1] justifies the study of astronomy in the following terms:

Astronomy is a science which has, in all ages, engaged the attention of the poet, the philosopher, and the divine, and been the subject of their study and admiration . . . Astronomy has been of immense utility to the science of GEOGRAPHY . . . likewise of great utility to the art of NAVIGATION . . . no less useful to AGRICULTURE . . . and the science of CHRONOLOGY likewise depends on celestial observations . . . Astronomy has likewise lent its aid to the PROPAGATION OF RELIGION . . . and has tended to DISSIPATE SUPERSTITIOUS NOTIONS.

Independently of the considerations above stated, the study of astronomy is attended with many advantages in a moral, intellectual and religious point of view.

1. This department of science unfolds to us the most striking displays of the perfections of the Deity.

2. Astronomy displays before us the extent and grandeur of God's universal empire.

3. The objects which this science discloses, afford subjects of sublime contemplation, and tend to elevate the soul above vicious passions and grovelling pursuits. [The explanation following this heading is a masterpiece of onomatopoetic description, such as: "Or, would he degrade himself below the level of brutes by a daily indulgence in rioting and drunkenness, till his faculties were benumbed, and his body found wallowing in the mire?"]

4. The study of astronomy has a tendency to moderate the pride of man and to promote humility.

5. The studies connected with astronomy tend to prepare the soul for the employments of the future world.

6. The researches of astronomy demonstrate, that it is in the power of the Creator to open to his intelligent offspring endless sources of felicity.

7. The science of astronomy is a study which will be prosecuted without intermission in the eternal world.

By 1839, with the publication of Professor Olmsted's text book for the students of Yale College, a considerably revised view of astronomy appears. He states in the preface:

Nearly all who have written Treatises on Astronomy, designed for young learners, appear to have erred in one of two ways; they have either disregarded demonstrative evidence, and relied on more popular illustration, or they have exhibited the elements of the science in naked mathematical formulae. The former are usually diffuse and superficial; the latter, technical and abstruse. . . .

According to our experience, however, but a few students in the course of a liberal education will be satisfied with arriving at a full conviction of the great truths of astronomy, and yet know very little about nature. They do not need so much to be convinced that the assertions of astronomers are true, as they

[1] Burritt, Elijah H., *The Geography of the Heavens and Class Book of Astronomy*, F. J. Huntington and Co., 174 Pearl Street, New York, Fifth Edition, 1839.

desire to know what the truths are, and how they were ascertained; and they will derive from the study of astronomy little of that moral and intellectual elevation which they had anticipated, unless they learn to look on the heavens with new views, and a clear comprehension of their wonderful mechanism.[2]

By the time that Olmsted's astronomy was written, the subject had become well established as a scientific discipline. Even in those schools where it remained a category under natural philosophy, the theological orientation was minimized. The emphasis was now on the value that it presumably held for inculcating reason, logic, and scientific (as distinguished from absolute) truth. Olmsted and others were obsessed with the mathematical purity of their field, and devoted chapter after chapter to celestial mechanics and the solution of problems.

Still more significant was the emergence of astronomy as a pure science. Jefferson had recommended in 1799 that a professorship be established for mathematics and astronomy as a part of the proposed reorganization of the curriculum of William and Mary. Harvard had installed a telescope as early as 1672, and had produced research on the Great Comet of 1680 that is reported to have been useful to Newton in his work.

Great new successes helped. Sir William Herschel discovered Uranus in 1781. Halley predicted the return of a comet. Mathematical astronomy progressed so rapidly that Neptune was predicted on paper before its discovery in 1846. More and more satellites were unveiled. Precise planetary observations triumphantly confirmed Newton's Laws of Motion and Law of Gravitation, and Kepler's Laws describing the planets' orbits.

The literature is rich with textbooks, picture books, ephemerides, observatory reports, and science fantasy from the last half of the nineteenth century. Over fifty colleges and universities constructed observatories containing telescopes, meridian circles and transits of excellent quality. Volumes of useful (and some useless) data resulted. In 1899, the University of Chicago opened the Yerkes Observatory with its 40-inch refractor, which is even now the largest telescope of that type. Nearly all of the eastern colleges and many others throughout the country had established professorships in astronomy. When the twentieth century dawned, astronomy was unquestionably a noble and respected component of the academic domain.

Somewhere in the early part of the new century, astronomy lost its hold on the academic imagination. Perhaps the reason was complacency on the part of some researchers, though the building of the 100-inch reflector on Mt. Wilson in California is evidence that new ideas still existed. Probably the belief that astronomy was a rather useless pursuit was more widely responsible.

[2] Olmsted, Denison, *An Introduction to Astronomy, Designed as a Text Book*, Collins, Keese, & Co., New York, 1839.

While other sciences were ascending, astronomy, in proportion to the total academic effort, was declining. During the first half of the twentieth century, the numbers of students receiving their doctorates in physics increased 32 times, in chemistry 36 times, in mathematics 16 times, but in astronomy only 4.4 times.

In the meantime, the insatiable desire on the part of the American citizenry for an understanding of the most simple astronomical concepts went virtually unanswered. While the few professional astronomers were busy calculating orbits for new comets, and in general polishing up their equations, natural curiosity about the unknowns of space continued to swell. The return of Halley's Comet in 1910, the discovery of hundreds of asteroids, the recovery of several large meteorites, and (in 1930) the discovery of Pluto all served to whet the astronomical appetite.

While professional astronomy had evolved through various stages from a nearly complete religious orientation through a "natural philosophy" basis, and, finally, to a concentration on celestial mechanics, popular astronomy had been largely neglected. Yet the aesthetic and emotional appeals of the subject for so many people, coupled with a sincere eagerness to learn, appear to have been largely responsible for the founding of the first planetariums. When Dr. Clyde Fisher of The American Museum of Natural History went to Germany in 1925 to examine the new Zeiss projection planetarium, he did so with the hope that something could be done to resolve the dilemma.

Max Adler, who donated the planetarium in Chicago, expressed his aim in the following quotation from his presentation address:

> The popular conception of the universe is too meager; the planets and the stars are too far removed from general knowledge. In our reflections, we dwell too little upon the concept that the world and all human endeavor within it are governed by established order, and too infrequently upon the truth that under the heavens everything is interrelated, even as each of us to the other.

Charles Hayden, donor of the Zeiss projector in the planetarium in New York, put it this way:

> I believe the planetarium is not only a place of interest and instruction but that it should give a more lively and sincere appreciation of the magnitude of the universe and of the belief that there must be a very much greater power than man responsible for the wonderful things which are daily occurring in the universe.

Similar statements concerning other installations can be found. It is clear that the major planetariums of this country were built to satisfy a concatenation of needs, but that the layman was the prime target.

Anyone who has visited the various institutions can report with certainty that there is little agreement on methods that should be used to accomplish certain objectives. Now, how does one set up a lecture pro-

gram, or exhibits, or courses, or combinations of all three, that will meet a planetarium's philosophical specifications? Perhaps we can isolate some types of representative programs.

Undoubtedly the easiest planetarium demonstration to prepare for the public is one that centers around the functions of the projection instrument. "From Dusk to Dawn" is a typical lecture. It begins with sunset, ends at sunrise. In between one is subjected to star identification, a parade of the planets in season, and possibly an explanation of the glories of Zeissdom and its mechanical progeny. For an especially astute audience, the precession of the equinoxes, the regression of lunar nodes, direct and retrograde planetary motion, and all the other displays inherent in the projection equipment are recounted. Such a lecture, if repeated without substantial change, year in and year out, is a kind of projector-worship. The planetarium instrument is on display, is put through its paces, and is illuminated with near-reverence at the artificial dawn ending the demonstration, and receives its accolades. Perhaps properly so. It is the instrument that has performed, not the lecturer. Many in the audience will have enjoyed what they saw. Probably they will have been awed and impressed. They may join the cult of projector-worship.

Yet, will they have heard a story, interrelated and simple enough to be challenging to the imagination and well understood? Is the endless exposition of facts, no matter how elegantly illustrated in three dimensions, adequate as a regular diet for planetarium guests?

There is, of course, the other extreme. This is the uninhibited soaring into the realm of science fiction, characterized most often by a space trip replete with imaginary (and obviously unreal) rockets—not neglecting the sound effects, the radar screens, the space helmets or the space platforms. Perhaps such a demonstration can be justified on economic terms; it is sometimes stated that such "spectacles" draw more visitors than the more sedate type of demonstration. Once the visitor is captive, he will learn something of astronomy. Or, in effect, the end justifies the means. The argument is easily toppled. Attendance figures prove that the institutions guilty of "projector-worship" are experiencing attendance trends quite similar to those institutions inclining toward enthusiasm for space travel.

The simple truth is that we are living in an age of unparalleled interest in astronomy. Since World War II, the subject has acquired new authority. The success of science as proved by the harnessing of the atom has endowed all of the scientific disciplines with greater prestige than ever before. Solutions of some astronomical problems of long standing have captured public fancy. For example, some new stars, previously unknown, have been discovered in the constellation of Orion. We may have witnessed their birth. A study of a special type of variable star has led to

new figures for the dimensions of the universe. The planetariums of the world have certainly served valiantly in assisting in the effort to explain these new developments to all. Now the planetariums are reaping the harvest in the form of constantly growing attendance. Thus, the question of how best to set up a worthwhile program becomes increasingly important.

To make a lecture in the planetarium effective and to assure that it achieves its objective, it must be adapted to the intellectual capacity of the average visitor, and must not be too "high brow" or weighty. Many people are deterred from visiting the planetarium by lectures that are too long, wholly instructive, or even pedagogic and wearisome. One object of the lectures is to induce the visitor to regard the planetarium not merely as an object of curiosity, but also as a place of instruction and edification which should be visited again and again.

Nearly everything must be explained as though it were entirely unknown. This applies particularly to those things done in a planetarium which seem strange to an unversed visitor, such as the fact that during the daytime, when the sun is shining, the stars are also visible, or that the sun which, during its daily course, apparently moves from east to west, actually reflects the rotation of the earth from west to east. What is understood by the lecturer may be totally incomprehensible to the visitor. Anyone who understands his business as a planetarium lecturer brings his lecture to a close like the parts of a serial, with an implicit "to be continued," so that the visitors leave looking forward eagerly to a return visit.

Great care should be taken in the use of technical and astronomical terms, while many technicalities should be avoided altogether. If, on the other hand, a lecturer announces something that is about to take place, such as "I will now turn on the night sky," the effect is naturally lost, and the illusion of reality is at an end. All that is left is a technical affair which evokes no special enthusiasm. A much better technique would be to prepare the audience for the spectacle by telling them to close their eyes for a few seconds, and to imagine themselves on a starry night on a peak high in the Rocky Mountains.

The lecture should contain an occasional reference to the practical importance of astronomy to human life and the purpose which it serves. The greater the popular and personal appeal of the lectures, the more they are confined to explaining, in short sentences, what the visitors actually see of astronomical phenomena and movements, the more likely they will be to induce visitors to return.

Dr. Morris S. Davis, Consultant in Astronomy at the Morehead Planetarium at the University of North Carolina for a number of years, has

this to say about the subject matter presented in a planetarium demonstration:

Of particular interest is the proportion of pure, unadulterated astronomy that is presented at any performance. As an astronomer and teacher, I feel that there should be a solid minimum of knowledge that we are certain has been imparted to the public. I do not minimize the need for unusual and ingenious special effects. All aids to the imagination, all ways to stimulate interest, all inducements to create proper mood, are welcome. Rather than present a complex subject in its entirety, it is better to concentrate on the fundamentals, omitting impedimenta, simplifying and illustrating basic ideas. The most expedient balance between information and entertainment is from one-third to one-half. That is, we should have the conviction that about one-third of the material presented is solid astronomical fact. The remainder of the time is given over to creation of mood, history, sidelights, general discussion.

As astronomy is one of the exactest of all sciences, there should be a conscious attempt at conveying precision. On the other side of the coin, in stellar astronomy, galactic structure and the study of external galaxies, we should not give the impression that astronomers have written the last word, for they have not. These and several other branches of astronomy are still partly speculative and therefore it behooves us to show how logic and certain physical principles force us to draw conclusions *now*, indicating that *later* observations may cause us to modify our results.

Finally, it is important to remember that the planetarium skies are only a substitute, and not replacement, for the actual heavens. I find some people deifying the planetarium when, it seems to me, they should be looking for God in the skies of nature.

One can accept the desirability of the noble spiritual objectives set by the eminent philanthropists who gave their financial aid to the planetariums in the United States. The program planner may decide to chart a mean course between the pedagogic and the fantastic. He may wish to abide by the formula for astronomical content proposed by Dr. Davis. The implementation can still be elusive.

An approach that has proved successful consists of starting with a subject or theme. It should be timely; for example, regarding planets when they are in good viewing position or eclipses when an eclipse is expected. The theme should be attractive to the anticipated audience and the title should be chosen with care. A sequence should then be developed—a "story line." When the theme has been adapted, studied, and delineated, thought should then be applied to the means of illustrating successfully. Invariably, the planetarium projector will be utilized. It should not be an end in itself, however. Whatever is done with it should depend on how well it serves the prescribed purpose.

Any other visual device that adds to the authenticity or clarity of the

exposition should be considered. Planetarium technicians have invented hundreds of special projectors to meet this requirement: eclipse machines, rainbows, clouds, aurorae, horizon scenes, and many others. The developments or adaptations of such devices should invariably *follow* the decision on subject; the program should not be built around a gadget or gadgets.

Sound effects, music, special lighting, motion pictures, and even decorations can often be used effectively to create a mood or to add an aesthetic dimension. Again the test: do these techniques add to the effectiveness of the predetermined teaching objective? If so, they may be justified.

A discussion of the popular lecture in the "sky theatre" is just one aspect of the total philosophy in a planetarium as an institution. There should be many other types of lectures. Courses in astronomy, navigation and allied subjects can be offered. Research should be supported: in the development of new techniques and devices to illustrate the planetarium demonstration more fully; in fields that will assure the maintenance of the professional status of the staff; and in the accretion of new knowledge. Exhibits, displays, symposia, science fairs, and information services to the press media and the public are also important. There may be a cooperative effort in support of the amateur astronomy clubs in the community, and with the schools. Each of these subjects merits separate consideration.

The planetarium has an important scientific and cultural mission in the community. It is becoming increasingly urgent that this responsibility be reflected in the activities accepted by the planetarium and the program that is offered to the public.

Museum Standards

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With such a fundamental subject as this, it is difficult to know where to begin, especially when the majority of one's readers are American. Standards of museum building and design have already been adequately dealt with by Laurence Vail Coleman in his indispensable books. The inventiveness and attractions of world fairs have set standards for all of us to copy in many cognate directions. An American—Professor Birkhoff of Harvard—even invented a formula for the measurement of esthetic values.

In the light of these achievements, it is unlikely that anything I can say will be sensational or even instructive. But perhaps sensation is better kept out of the museum, and I realize that even in a country so vast, and so rich in resources and talent, as America, it is almost impossible to plan and build museums on entirely new lines. Some interest may therefore be aroused by the attempt to analyze the relative values of museum standards.

"What are standards?" is a pertinent question. They are not, I hope, just other names for convention or the approved pattern, whether it be in museum architecture or in display. Surely they are not the expectation that all curators be cast in the same mold or have the same university degrees. Are we to consider standards for the practitioners of museology or those who visit the museums?

And who among us is to be the judge?

One of my friends, a distinguished museum administrator and mineralogist, once told me of a conversation he had just had with his housekeeper. It had been one of those days of political crisis a few years ago and ominous headlines stretched across the newspaper. He called the lady's attention to the bad news and asked her what she thought about it

all. "Sir," she said, "whenever I see anything like that I always take the broad view. I say to myself, 'How does this affect me?' "

I am certain that many of us take a similar broad view in our museum affairs and in our dealings with our fellow workers. Where our tastes, our purses, and our predilections are concerned, just how broad are our views?

Many museums are long established, their arrangements made for better or for worse. There is perhaps no other kind of public institution where almost anything serves as a building and where inside it almost anything goes. Space and money are the two imponderables of the museum equation in every country. Without these we can do little; with them we can sometimes make many mistakes. I see in this, unpopular though it be in some quarters, a constant need for trustees, for the fellowship of men of affairs, not blinded with professional jealousies or obtuseness, who have access to principalities and powers above the curatorial level. This does not mean overriding officialdom, nor the acceptance of sameness or even of commercial standards for museums (though there can be worse). Nor does it mean that the present motto of many museums, "Where to be constant were inconstancy," is an admirable one.

In Britain we have a multiplicity of museum administrations: national, city (municipal), county, society, private, and even psuedo-museums (which are really trading organizations). Our Museums Association includes all of them in its membership except the last. Such a variety of methods is embraced in the financial structure of these that standardization of administration systems is difficult. The staff position is of necessity equally difficult. Some museums can command almost any kind of person; others are lucky to get an incumbent at all. It would not seem to matter, perhaps, if the rule were that a community gets the museum it deserves, but things are not so simple. All the best museums are not in the largest centers of population, and many fine collections have grown up in rural situations where the financial resources are inevitably small.

We have to remember, too, at least in Britain, that the days of individual patronage are almost over. The merchant princes, the millionaire industrialists, are fewer and often less interested. By necessity, governments are becoming the patrons of art and science, accessions are being made on national or state funds, and perforce the museum administrator, rather than the museum curator, often becomes vicariously the arbiter of taste. The entrant to the profession thus needs additional careful screening for a new standard of perfection.

In the United States there are training standards and favorite training grounds. As yet, I believe, there is no cut and dried diploma scheme such as we have in Britain, but there are university museums which in size and scope, staffing, and administration, are entirely different from ours. Yet I venture the caution that one may be misled by training schemes and diplomas, valuable as they may be. On the one hand, academic qualifica-

tions are not enough. The holder of a Ph.D. in a subject may not necessarily be a good museum curator of that subject, though obviously he has the foundation on which to build. I am well aware that many of the things museums do are also done elsewhere, but I still insist that the profession of the curator is a separate discipline, not to be entered through college training only and inseparable from training and experience in a museum. In Britain, our diploma scheme, with all the assurance of its twenty-five years, insists on this. On the other hand, with training schemes and with examinations based upon them, I fear we are sometimes in danger of confusing examination standards with museum standards.

Not all of us, even in our profession, are free from common errors in the English language. How often on the hoardings are we exhorted to buy our "homes" from so-and-so. What the advertisers mean, of course, is houses, or, sometimes, furniture. Houses are easily built and furnished; homes are the accumulation of joys and sorrows, of richness or poorness, over the years. You cannot buy or make homes instantaneously or by bespoke methods. Similarly, a museum is not just a building furnished with cases, however architecturally bright and modern they may be, however valuable the contents of both. That is obvious. From it, it is clear that the art of museums is neither architecture nor electrical engineering, nor even case designing. It is the display of the objects so that their nature, usually little known to the visitors to the collection, tells a story. For this purpose, the objects themselves must be collected, prepared, and preserved, identified (which means research and the use of specialist knowledge in some discipline) and *interpreted*. However much visual aids, visitor-operated explanatory diagrams, and museum internal broadcasting systems may be used, the materials in the cases must themselves tell a story by their arrangement and labeling. This is the hardest art of all and is the standard by which the curator and, indeed, the museum he controls will be judged. He cannot be held responsible for the quantity of materials at his disposal, or the money in the corporate bank, but he is directly responsible for the use that is made of his specimens. On that he will rise or fall, just as surely as a musician is judged by the quality of his execution rather than that of the compositions he plays.

It follows from this that of the official "fixtures" the curator is the most important: the art of curatorship is the art of museumship.

In Britain we have tried, through the training courses and publications of the Museums Association, to assure the maintenance of an adequate standard of curatorship. The standard is not necessarily the same for all, as, people being what they are, with their different backgrounds, social, cultural, and emotional, it is unlikely that equality of output can be expected. Yet we must try to attain some quality of status and financial return for the different practitioners of so many differing institutions. To a large extent our Museums Association Diploma has done just that.

In our unique local government system the difficulty in the past was to devise some recognizable qualification. The diploma of the Museums Association has filled this gap and forms a basis upon which status, salary, and promotion rates in non-national museums can be gauged. This recognition makes the Association's educational and training schemes essential for new entrants, and from now on there seems a fair prospect of a flow of reputable personnel, bearing the same hallmark and knowing something of the same methods, but naturally differing in academic gifts and personal ambition.

The diploma scheme will itself progress and improve, but it can never achieve full success unless it maintains the essential humanity of the museum official—a point often overlooked but of vital necessity in a task that depends on community reaction.

In Britain we have had for the last twenty-five years or so another yardstick of value. It has been provided by the Carnegie United Kingdom Trust, the sister of the Carnegie Corporation of New York. Among many other virtues, it spends money on museums. The museum applies for a grant; a joint committee of the Museums Association and the Carnegie Trust considers the application and appoints a reporter to examine the scheme that is the basis of the application, the museum, and—not least—the local people who will carry out the work. If the members of the committee are satisfied, a grant is made, to be spent on exhibition only and not on the fabric of the building. Many British museums have been helped in this way, and it is a reinforcement of the argument about the curator's key position that, despite similarity of schemes and the amounts of money awarded, despite similarity of materials and cases, the individuality of the different museums has been kept, thanks to the overriding personality of the curator in charge.

Another valuable lesson has also been learned, as one would expect: that the recognition of the worth of a local museum by an external authority, moved sufficiently to donate money, is a forceful tonic to the trustees of the institution and the community it serves.

Our Museums Association has tried to keep in step with other standards by having an Architectural Committee to consider problems of rebuilding war-damaged museums and to advise on the highly specialized requirements of museum buildings. The co-operation of the curator in the planning of a new museum is an essential that is not always attained.

We try, too, to maintain some touch with the advance of the interpretative media of radio, television, and the film, difficult though that may be. But I do not intend to discuss this, as all Americans have much more experience in these aspects of communication. I believe that of the communication media television will ultimately learn much from museums and conversely will contribute to museum popularity and to the spread

of culture, but I also believe that that day has not yet come.

Museums do not exist for their curators, and it may be asked how much we have considered the standards for visitors, both the uninitiated and the initiated, whether in organized bodies or as lone seekers for knowledge. There are still standards in plenty to be set for them. I do not mean just comfort stations and cafeterias, though much could be said about them. I mean the need for serious attention to non-slip flooring, seats for old and young, some attention to visibility of labels and their types and colors, the optimum heights at which labels and objects should be set, and some faint recognition of the fact that museum visitors differ as much in physical and physiological characters as they do in health and educational background.

When one thinks of all these points, all these difficulties, I am reminded of an experience I once had with the great English mathematician, Sir Arthur Eddington. He asked me at lunch one day if I knew anything of mathematics and I answered, very truthfully, that I did not. He surprised me by saying that he was not very sure that he did either. He went on: "I define mathematicians by saying that they start with an unknown quantity, proceed by methods which they do not wholly understand, and so obtain a quite incomprehensible result." I often wonder if the process is confined to mathematicians. The great hope lies in that apparently the mathematicians and the museum men and women realize their weaknesses and are thus capable of taking heed and making progress.

The poets do not seem to have had much to say about standards, but I remember Wordsworth's lines:

> Who taking counsel of unbending truth,
> By one example hath set forth to all
> How they with dignity may stand; or fall
> If fall they must.

If we can stand with dignity as a profession, then we need no other set standards. Sir James Barrie, the Scottish playwright, once wrote that "Courage was the first of all the virtues, for without it there was no security for any other." Whether or not we have all taken counsel with unbending truth, the museums in Britain and in the United States stand as attempts at the interpretation of truths. They are small but free universities, demanding no certificates, operating no bars of creed or class, without iron curtains anywhere.

In general, that grand concept may be enough. Time alone will decide if its dignity will stand or fall. Variations on the theme, of course, will appear, will flourish, and may vanish. But, rising or falling, they will have their stimuli, and nowhere can they be better interpreted, praised, or even condemned, than in the freedom of the pages of CURATOR.

Scale Models in Exhibition Concepts

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Any exhibition, of whatever nature or size, has as its most essential quality the element of the third dimension. For this reason the most direct approach to the conception and planning of exhibitions is in working with scale models. From the moment a particular story, an area of knowledge, or even a single specimen is selected for exhibition, it is helpful, in fact essential, to move into the actual kind of space relationships in which the finished exhibit will exist.

From the point of view of the exhibition designer, working in three dimensions represents a method of visualization. Just to create a small illusion of the exhibition space to be occupied, with a human figure to scale, sets the imagination working on a three-dimensional basis. Concepts and design ideas will be stimulated, which would never have occurred in two-dimensional layouts on paper. Relationships in depth will suggest themselves, such as advancing or receding positions in a group. Possibilities of arrangement will come to mind, such as a revolving drum to carry information based on the cycle of the year. In these and in many other ways, some too subtle to define, design is formulated in the proper medium of the exhibition space itself.

As the model is a medium of creative visualization for the designer, so it is equally important as a medium of communication among all the people concerned with the planning of the exhibition. The curator, who has organized the subject and selected the material, is thus able to comprehend the possibilities and the limitations of the exhibition and display medium. He will be able to check the effectiveness of his choice of material for exhibit, to look at it as a spectator does, to try to grasp the sequence and development of the subject, and to weigh the impact of the various elements in a visual relationship, approximately as if he were confronted with them in actual three-dimensional space conditions.

Fig. 1. Model for a complex paleontology exhibit, telling about the origin of fossils, methods of collecting them, and aspects of their interpretation. Covering twelve case sections around a semicircular alcove, this subject presented a problem of visual organization which had to be solved at the very outset. This one-inch scale mock-up made it possible, with a minimum of labor and means, to try out the great number of alternatives that had to be considered in order to arrive at a satisfactory design for the entire exhibit. Colors of back wall panels were juggled, in some instances, to produce the best possible indication of breaks between sections, and in other instances to establish continuity within a section.

In the early planning stages, the usefulness of a model is in almost inverse proportion to the perfection of detail with which it is made. This is a working tool in the development of a plan, and as such should be carried only to such a level of completeness as is justified by this purpose. Four pieces of cardboard will become a room as soon as even the crudest stick is placed inside for a human figure, and major aspects of the exhibit can be adequately considered in this form.

For this reason, it is also advantageous to work at a scale as small as possible in proportion to the finished exhibit. For the first step in design

Figs. 2 and 3. Two phases in the cycle of a moving exhibit on timber. An overall photograph serving as a symbol of the raw material of timber is divided into panels. The panels revolve one at a time and each presents on its opposite side a major use to which timber is put. The idea of starting with one element and literally "turning it into" other forms could, by using a model, be experimented with in the essential terms of the full-sized exhibit. The interest inherent in a moving display is intensified by a sequence of brilliant colors on the backs of the panels. Each panel stops turning with the colored side facing the spectator while the succeeding colors unfold; when all the colored sides face, they all turn back together to form one whole photograph, and the cycle begins again. Scale: one inch to one foot.

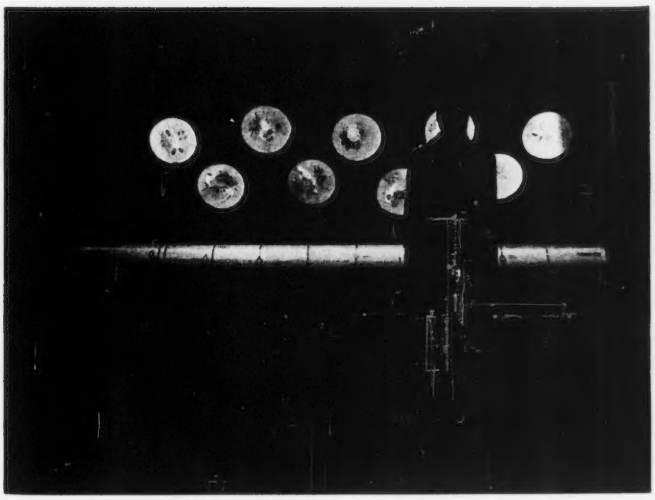
Fig. 4. Model for an exhibit on forest insects. Magnified models of nine insects were to be shown, together with their life cycles as related to the time of the year when they caused the most damage to trees. The crowding of space which would have resulted from including all this material on one panel was relieved by locating the life cycles on a revolving drum on which the annual cycle was marked off. Lighting is seen to work well, with the large models illuminated from behind the back panel, and the drum illuminated by overhead lights located in the top of the case. Scale: one inch to one foot.

is concerned with organization, whether the exhibit is to be an entire hall, a temporary display free-standing in a certain area, or a single wall case which is already built. The large relationships of the major divisions into which the subject is broken down can be seen in their over-all aspect; the elements making up these divisions should at first be treated very broadly and considered only generally at this point. If a total form for the exhibit is not established at this stage, it is unlikely that one ever can be very clearly developed.

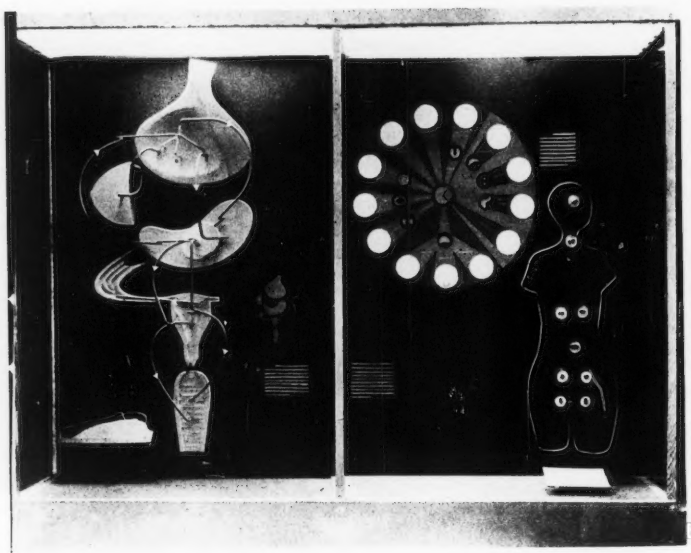
As problems that involve more detailed considerations are approached, it may be necessary to work at a larger scale. Where a closely integrated story is to be told—one that requires the coordination of labels, diagrams, models, and specimens for complete exposition—a scale of one-fourth actual size may make it possible to indicate and allow for all the essential elements and to give a suggestion of enough detail to provide a sound basis for planning.

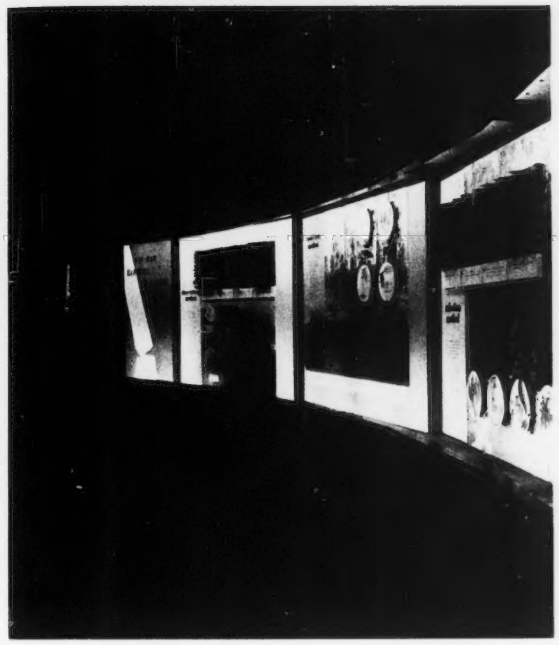
The preliminary design model can thus be a flexible medium for trying out ideas. Alternative positions of specimens in a case or of cases in a hall can be found and tested quickly and easily. New possibilities can be examined, and the hand and eye can move with the mind, each supplementing and stimulating the other, to discover ways of exploiting the maximum potentials of three-dimensional space.

Many specific problems can be solved by designers working with scale models. Structural matters can be considered, such as a method to support an exhibit, or the need to keep to a certain size a panel to be inserted into



Figs. 5 and 6. Above, model of an exhibit on methods of cutting timber, and opposite, the finished exhibit. A scale of one and one-half inches to one foot made possible the planning of all elements, including labels. Also, the use of three-dimensional space could be controlled and organized within the confines of an extremely shallow case. The three major divisions of the story were designed as three wide flat panels that were set at a slight angle, creating a step and thus enforcing the separation between them. The exact amount of projection of the smaller units from the back wall could also be established.





a case. Aspects of lighting can be observed and experimented with, to provide adequate illumination, to avoid shadows cast in the wrong places, and to discover unexpected dramatic effects. Many questions that involve three-dimensional space can be answered, such as the lateral limits of visibility at the back of a case, interference with vision by objects near to the spectator, and desirable planning for traffic flow in a large area. Adjusting elements to scale in a three-dimensional model rather than on drawing paper may, for example, reveal monotony in an original selection of material. A specimen can be demonstrated to gain in effectiveness if another specimen in its vicinity is presented in the form of a photograph

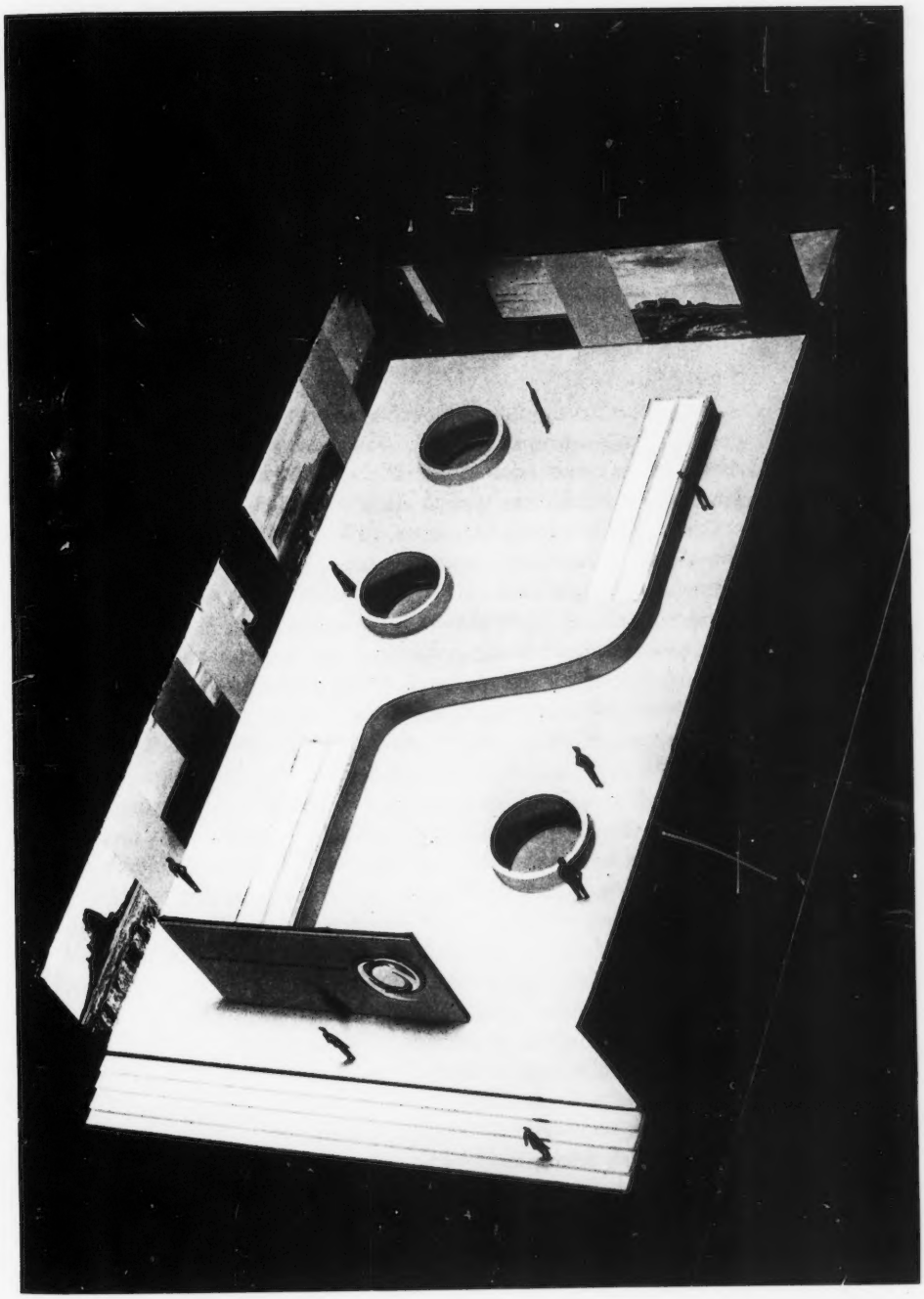
Fig. 7. Design of a case for the Hall of the Biology of Man. Scale: three inches to one foot. Where exhibits must be entirely created, as in this example, to explain the functions of the human body, a three-dimensional model is intrinsic to the conception of the display material. The story of hormone activities in the left-hand section was based on a text-book diagram. It offers a good example of the nature of the impact resulting from the translation of two-dimensional material into the third dimension. What appeared in the text-book as a series of shapes abstracted from natural forms, now assumes a new "reality" in becoming a group of three-dimensional objects again. At this scale the finished exhibit could be planned exactly for direct execution in full size.

Fig. 8. Model for a temporary pavilion on the arts and crafts of the Southwest Indians. Here the design was primarily an architectural problem, dealing with a space eighty feet by forty feet. This simple model with removable walls and roof, perforated to admit light, makes it possible to solve problems of entrance and exit, changes of the floor level, traffic flow, and the outlook from different positions along the spectator's route. The idea of running continuous photographic murals of a desert horizon around the walls could be realistically executed at this scale, and the effect of punctuating panels of color could be accurately adjusted. Scale: one-quarter inch to one foot.

or drawing; the contrast in medium thus created between them will actually heighten the interest of each.

It must also be recognized that there are many problems in the design of exhibitions that a model cannot solve. Preliminary estimates of adequate sizes in which the finished display elements will be made sometimes must be revised in spite of careful study beforehand, for problems arise in the actual execution of the exhibit which cannot always be anticipated. Each stage is thus a new experience and offers opportunity for imagination and creative ability. Even after the most thorough consideration and exhaustion of methods of visualization, experience does not fully prepare us for the excitement and surprise of the exhibit itself.

The over-all design may have to be worked on in various stages in the development of different exhibits, according to the peculiar needs of each. In some instances, the design of certain parts of an exhibit may have to be worked through in some detail before even a rough judgment can be reached on its general form or size in relation to the rest of the exhibit. This was true in certain aspects of the interpretation of fossils in the paleontology exhibit, illustrated in Figure 1. On the other hand, in the Hall of the Biology of Man project, illustrated in Figure 7, it was necessary to make a preliminary tentative mock-up of some subjects in order to get an idea of the effectiveness of one choice as against another as a means of telling a particular story. In other instances, problems of how to make clear the relationship of the parts in the explanation of a complex story can be solved by physical means such as position, color association, or structural connection in working with three-dimensional models. In all cases, however, the over-all design is the over-riding consideration and must be constantly referred to. The relationship of any single element to the rest of the exhibit must be adjusted in terms of the basic visual aspects of size, position, color, form, and the material of which it is made. Many of these relationships can be kept under control by working with a scale model as the work progresses.



The Teaching Functions of Exhibits

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THE AMERICAN MUSEUM OF NATURAL HISTORY

About fifteen years ago, at the old New England Museum of Natural History in Boston, there was an effective exhibit on museum exhibits. It consisted of two vertical showcases of identical dimensions. Crowded into one of these were multitudes of sea fans, starfishes, sea shells, and other marine bric-a-brac. Each had its little label, giving the proper scientific name, written in long-hand with a snub-nosed pen. To make the exhibit even more "authentic," the preparator had even treated the labels with a mild acid to make them brown and brittle, as though oxidized with age. A small incandescent lamp illuminated the case.

In contrast, its sister case contained a single large seashell on the order of a conch. A piece of light blue-green cloth had been draped in flowing lines over the back and bottom of the case. With the shell artistically positioned on the cloth, the folds emphasized the coils of the shell. At the bottom was a clean white sign with bold letters: DESIGN IN NATURE. The whole was illuminated by a fluorescent tube.

A bit of further explanation of the two showcases was provided by a sign beside each. It was explained that the first case represented the "old-fashioned" exhibit; such exhibits were useful only for identification. The second was a "modern" exhibit; a single idea was presented to the public. Many who saw the exhibit said it was the best in the museum at the time. (And the old place had some pretty good ones, too.)

This exhibit was good because it was teaching a simple lesson. Visitors to museums are largely casual visitors who come just to look. They are not interested, for the most part, in masses of factual information. They probably do not even want to be taught. The teaching difficulty posed by this situation is stated by Gates, et al., (1948): "Since learning is such a complex process, it is not surprising that it takes place most surely when one *intends* to learn and remember . . . Sometimes only passing reference or casual observation will be sufficient to learn; more often they will be

ineffective. Experiments have demonstrated that one is often unable to recall many details of objects he has handled numberless times or of scenes he has passed regularly. The facts suggest that the safest procedure is to attend directly to the important facts and principles or the essential skills to be acquired."

The practical aspect of this is pointed out by Haas and Packer (1950): "The countless number of billboards spread across the country has only one purpose—to put across an idea in one fleeting glance."

While a museum visitor's view of an exhibit is more than a fleeting glance, it is, on the other hand, far less than an intense study. By far the most of the museum visitors are constantly on the move. It would therefore seem a reasonable conclusion that an exhibit should be limited to a single idea or two.

This principle of a one-idea exhibit is not new in the field of education. In fact, it is one of the classic rules of teaching. Yet many museums seem not to have learned it. Their showcases are jammed full of specimens placed on display because they represent a synoptic series or somebody's prize collection. Lined up against the wall behind glass will be found a shelf of woodpeckers, a shelf of flycatchers, a showcase full of wood warblers. In another room can be found all kinds of minerals from all over the world, with not one word of explanation about how igneous rocks are formed. The public wanders in, views the array, wanders out, and promptly forgets just what it did see. In no way do such exhibits broaden the base of learning upon which a visitor may further expand his horizon of understanding.

Many persons are not aware of the forces which create mountains or tear them down. The forces creating earth forms (intrusion, extrusion, rising and sinking of portions of continents, erosion) are fundamental principles of natural history. Such concepts should be presented to the public. Seasonal changes in bird plumage, Allen's rule, migration routes, predatory relationships, or any other ecological principle would make an excellent idea for an exhibit.

This principle of teaching through exhibits can also be applied to habitat groups and small-scale dioramas. Ask yourself if it is wise to clutter a habitat setting with a large assemblage of animals intended to show all the kinds that might be seen in the particular habitat portrayed. Is this a habitat version of the "old-fashioned" exhibit? Bird exhibits are generally the worst in this respect. An example in The American Museum of Natural History is the New Forest exhibit in the Birds of the World Hall, which displays fifty-one species of birds.[1] The writer has passed this

[1] The presence of an owl is used to explain the concentration of birds, but the unlikelihood of an owl attracting one each of fifty-one species makes this explanation untenable.

exhibit numerous times, studied it and read the labels on several occasions, and remembers only that there are lots of birds in a beech tree and that it has something to do with Theodore Roosevelt. The present writer may be a bit dull, but he insists that he is no duller than the average of the general public.

It may be argued that a habitat setting does not have to be absolutely natural, that a purpose may be served by deviating somewhat from a typical or normal situation. The writer accepts this position on the condition that a useful purpose *is* positively served and that the educational value *is not* reduced by cluttering. That cluttered exhibits may be somewhat misrepresentative is but a minor point; the important criticism is that they are generally ineffectual. A more useful purpose could be achieved by limiting the exhibit to one species of animal, pointing out an adaptation to its environment. The beaver group in the North American Mammal Hall in the American Museum shows beaver putting their teeth to work on aspen growing near a dammed-up stream in a Michigan forest. The effect of the beavers' work on the environment is clear. No other animals interfere with this central theme. A principle is more important than an assortment.

Dr. Robert Oppenheimer, in a recent lecture at Harvard University, pointed out that man is faced with the problem of mastering and integrating a rapidly accumulating mass of knowledge. There clearly devolves upon educators the responsibility of streamlining their teaching into a highly efficient art form. No longer can we teach and hope there is learning taking place. We must teach and be sure. Trained museum educators must take the responsibility of seeing that museum exhibits are more than a free Sunday afternoon entertainment for the public.

BIBLIOGRAPHY

Gates, Arthur I., Arthur T. Jersild, T. R. McConnell, and Robert C. Challman: *Educational Psychology*. Ed. 3. The Macmillan Co. New York. 1948

Haas, Kenneth B. and Harry Q. Packer: *Preparation and Use of Audio-Visual Aids*. Ed. 2. Prentice-Hall, Inc. New York. 1950

The Use of Scientific Study Skins of Birds

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The public thinks of specimens of birds in museums as always represented by the conventional "stuffed" or "mounted" specimens which have been prepared in more or less lifelike attitudes by taxidermists. The scientist, on the other hand, thinks in terms of so-called study skins. These are filled with cotton or tow in a position resembling that of a dead bird. A tag is affixed to the feet, giving the important scientific information as to when and where the specimen was collected, its sex, and other data. Once such specimens are dried, they may be packed like so many rows of sardines in flat trays. The bird section of The American Museum of Natural History easily accommodates a collection of some 800,000 such study skins of birds. Were all the specimens mounted, the number that could be accommodated would probably be not more than one one-hundredth of that number, and the result would be an appalling series of dusty stuffed birds such as one does indeed find in a few ancient museums.

The museum visitor—and also the sportsman—as noted above, think of bird specimens in terms of properly mounted examples of the taxidermist's art. Well-prepared and with suitable backgrounds, such mounted specimens of the more attractive or colorful birds may indeed be most appealing. Unfortunately, with the passage of the years the number of first-rate taxidermists, at least in the United States, seems to become smaller and smaller. Fifty years ago, more or less, among the pupils in taxidermy at Professor Ward's natural science establishment at Rochester, New York, one could find such outstanding individuals as Frederick A. Lucas, later to become Director of The American Museum of Natural History, and William T. Hornaday, later Director of the New York Zoological Park. Journals of taxidermy were published, and among the practitioners of this trade were individuals, such as the late Carl Akeley, who were ac-

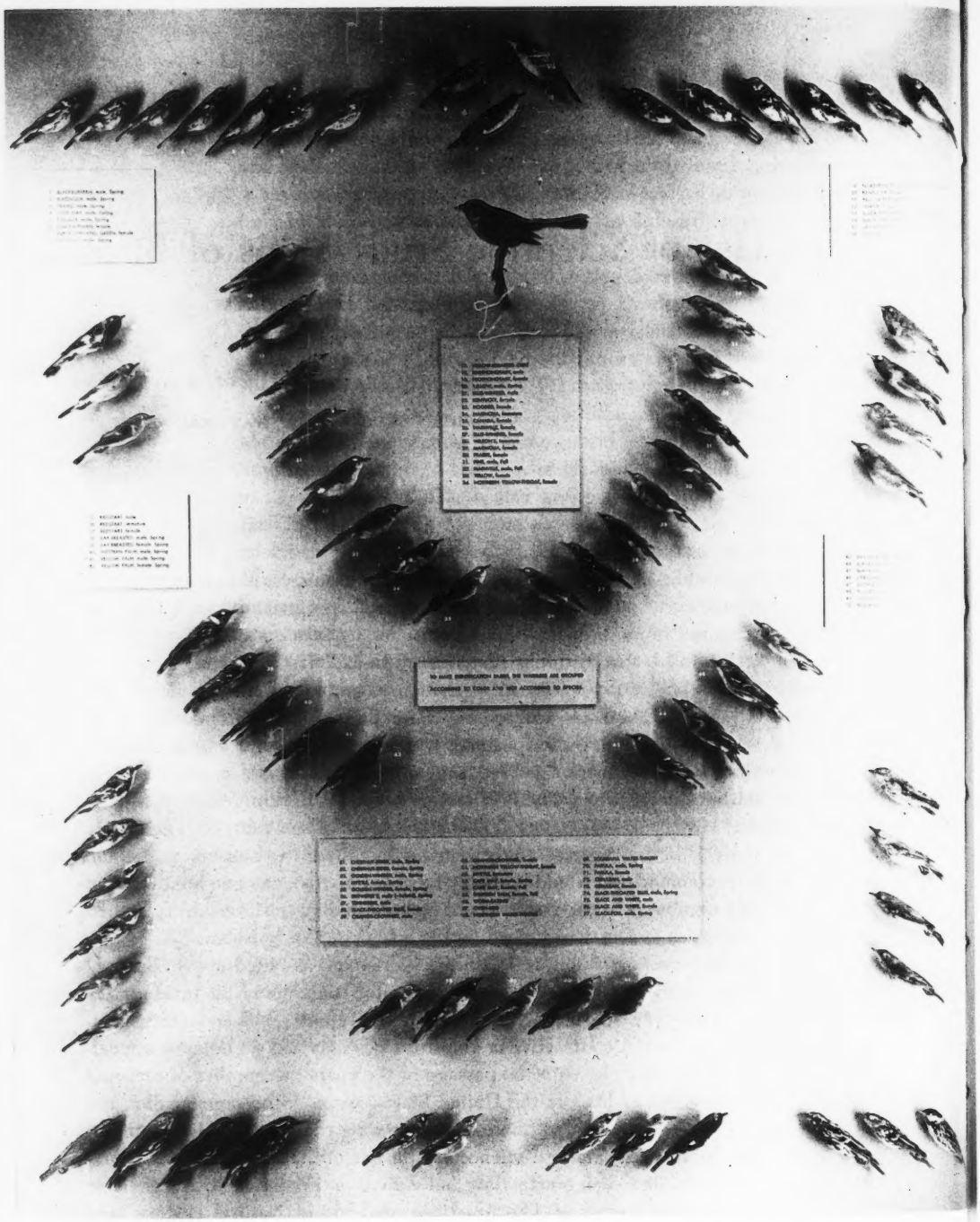

Fig. 1. Many species of birds are so similar as to puzzle the field student. The use of study skins permits ready comparison.

Fig. 2. Study skins in combination with a few mounted birds may be arranged in attractive exhibits.

complished artists and sculptors in their own right. Nowadays taxidermists, with some exceptions, are apt to be rather poorly trained, unimaginative individuals whose work consists mainly of quickly skinning deer scalps or pheasants and supplying them with factory-made papier-maché bodies, thus turning out a limited and rather inferior brand of taxidermy confined to a few standard game species. Such taxidermists are, as a rule, able to work only with fresh material, whereas for museum work in large institutions it is absolutely essential to have someone who can prepare satisfactory mounted specimens from study skins which were collected decades earlier. To relax and mount such old, dried specimens of birds is indeed a delicate and specialized art, and to find a taxidermist capable of doing it is at times well-nigh impossible.

The changes in the taxidermist's profession, here briefly mentioned, are in part a result of changing ideas as to interior decoration. Modern design emphasizes clean lines and absence of fussy or "busy" detail. Needless to say, mounted birds, their glass eyes soon glazed with grime and the spread wings acting as dust catchers, are scarcely the type of bric-a-brac

prized by modern interior decorators. On the other hand, scientific study skins, although their form was originally dictated by standards of quick field preparation and economy of temporary and permanent storage, are streamlined objects which are in no way an affront to modern surroundings. Even in the field of big-game trophies one notices the same trend. A pair of graceful kudu horns, with just a bit of polished skull remaining as a base, is in vogue today, while the hunter who contracts to have the entire animal stuffed is apt to dwell in somewhat mid-Victorian surroundings.

The above rather lengthy preamble permits short treatment for the main point of the present contribution. The Department of Birds of The American Museum of Natural History was asked to prepare a new exhibit of birds of the New York City area. The old exhibit was completely antiquated; yet the great increase in the number of bird watchers made the need for such a display urgent. We decided to use study skins in the new exhibit, though including a certain number of conventional mounted birds. As intimated above, this decision had much to recommend it. First, there was the difficulty of finding competent taxidermists. Second, great savings could be made by using scientific specimens already available, instead of having them stuffed at a cost of from fifteen dollars to fifty dollars apiece. Aside from the advantage economy-wise, it was believed that the over-all appearance of the exhibit might be improved by this policy.

Admittedly, some spectators are a bit puzzled by study skins and wonder when these birds are going to be "stuffed" and the exhibit completed. Actually, such a display is a utilitarian one, even more than most others in the Museum, and from the actual bird watchers to whom it is addressed have come few or no complaints. To be sure, a specimen mounted carefully by a taxidermist familiar with the bird in life, and depicting just the right attitude and profile, is of greater help in field identification than a study skin. However, many of the good bird books on the market provide the student with a better introduction to the attitudes of the species he is seeking in the field than do poor mounts. The great value of an exhibit of actual specimens is that it permits evaluation of color pattern, size, and bill contour more accurately than is possible from the illustrations in a field guide. These aims can be accomplished by study skins as well as by mounted specimens. Furthermore, a larger number of study skins can be shown in a given exhibit space than is possible with mounted specimens, and thus a correspondingly greater variety of plumages will be available for the student. All in all, therefore, we hope that the extensive use of study skins of birds in this exhibit, which is intended primarily as an aid to identification of local birds, has been a success.

Museum Installations of a Semi-Permanent Nature

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To anticipate the planning and construction of sixty major exhibit areas in the new Museum of History and Technology, the Smithsonian Institution's curatorial and exhibition staffs have undertaken a program rarely ventured in museum work.

The construction schedule of this new building, to be located on a Mall site between 12th and 14th streets, calls for a completion date in late 1961 or early 1962, and an opening date with all exhibits installed and available to the public in 1963. In an existing building, the planning and construction of so many exhibits in so short a time would be a considerable task. In a building which at this writing is little beyond the diagrammatic design stage in planning, the problems of exhibit planning and construction become amazingly complex. We have, however, considered this and after careful examination of our resources have accepted the schedule.

In the last four years, the Smithsonian Institution has received from Congress yearly appropriations for necessary exhibits renovation work in the Natural History and the Arts & Industries buildings of the United States National Museum. It is this renovation work which has provided the opportunity to organize and season an exhibits staff with work on gallery-wide exhibits. For more than four years, a primary concern of the designers has been to produce exhibits relating to history and technology which will be as completely movable to the new building as practicable. It is interesting to note how increasingly portable these have become as the design of the building has progressed. The exhibitions discussed here reflect these changes in progressive order.

The first Arts and Industries hall renovation was the construction of

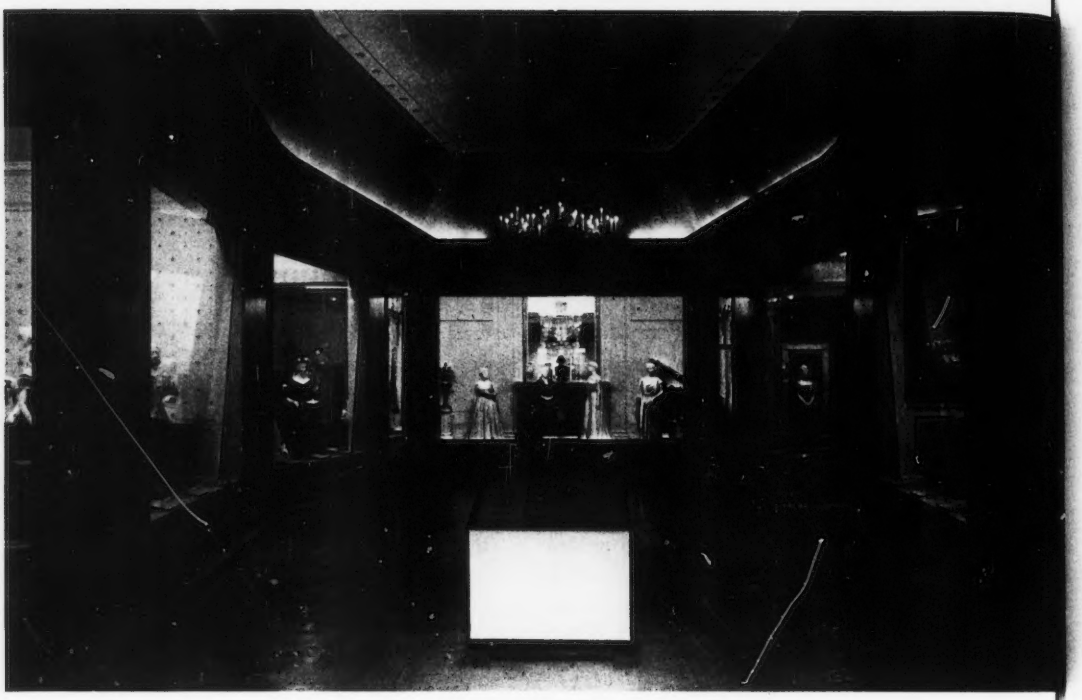


Fig. 1. Entrance view of renovated First Ladies Hall.

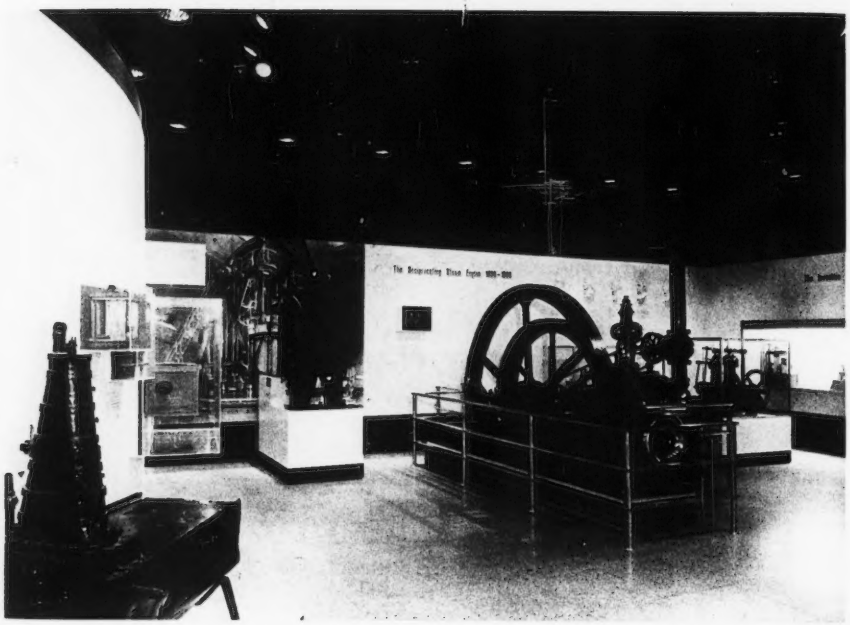
the exhibit of the First Ladies Dresses. This enormously popular collection has been presented for years in cumbersome, unlighted mahogany cases with little extra space available for displaying accessories, and none for exhibiting furnishings. The design of the new hall, as conceived by the Museum staff and the Public Buildings Service architects, achieved eight period room settings for the mannequins and gowns spaced around a lofty period hall occupying 4500 square feet of space. These display personal memorabilia of the First Ladies, with White House furniture and architectural trim, in effective lighting and proper chronology.

The collection setting is a semi-permanent one, in that the cases will remain in the old building. At the time this hall was designed, there was little prospect of a new building, and it was felt that even if a new building were authorized it would be difficult to anticipate the shape or

size of the new space closely enough to justify the expense of making these large units completely transferable. Also, it would be at least ten years before the exhibits could be moved again and, if the collections were displayed properly for even this time, the Museum would have opportunities to assemble furnishings from the White House (heretofore buried in scattered storage spaces throughout the Arts and Industries Building), attract desirable historical objects, repair the collections, and experiment with lighting and dress arrangements. In the seven years that the renovated exhibit could be open, it would be seen and enjoyed by more than thirteen million visitors. The construction was authorized, therefore, and by 1960 enough will have been learned about period room exhibits presentation and public reaction to make a major overhaul desirable (Fig. 1).

The designers of the Hall of Power Machinery were more fortunate, in that by 1954, hope was growing that the Smithsonian's need for a new building might be favorably considered. The staff was instructed, therefore, to design the Power Machinery hall to obtain a large amount of portability of exhibit units. The architectural considerations of the hall were 4500 square feet of space, generous thirty-foot ceiling, north wall windows, and terrazzo floor. To be displayed were many fine examples of power machinery, patent office models, scale models, charts, graphs, and diagrams. The great majority of this material could be displayed—and was, in fact, already displayed—out of cases and accessible to museum visitors. We felt that this was a desirable feature in the old hall and tried to retain some accessibility to the objects in the new exhibition. Thus, the heavier machinery was mounted on lacquered, movable bases complete with durable labels, and only the easily damaged material was cased.

As renovation proceeded, the demands for storage outstripped the space available, so the thirty-foot ceiling height in the Power Machinery hall was decked over to attain a second floor storage area of 4500 square feet. This made an interesting unfinished cement ceiling for the exhibit space below that is in keeping with the nature of the hall. The supports for this ceiling were incorporated into white plaster walls to match the four periphery walls. The plaster walls were constructed blank, with no built-in cases. All specimens were attached to Novaply panels and then mounted with plastic protecting envelopes of moderate cost. Specimens not requiring protection were attached to the wall studding by special brackets, and exhibits cases of a larger nature were mounted in a series of slots and rails concealed in three of the six walls. The exhibit (including two very large steam engines) can be moved when necessary to a space in the new building having the same general conditions, and can be arranged there as desired.



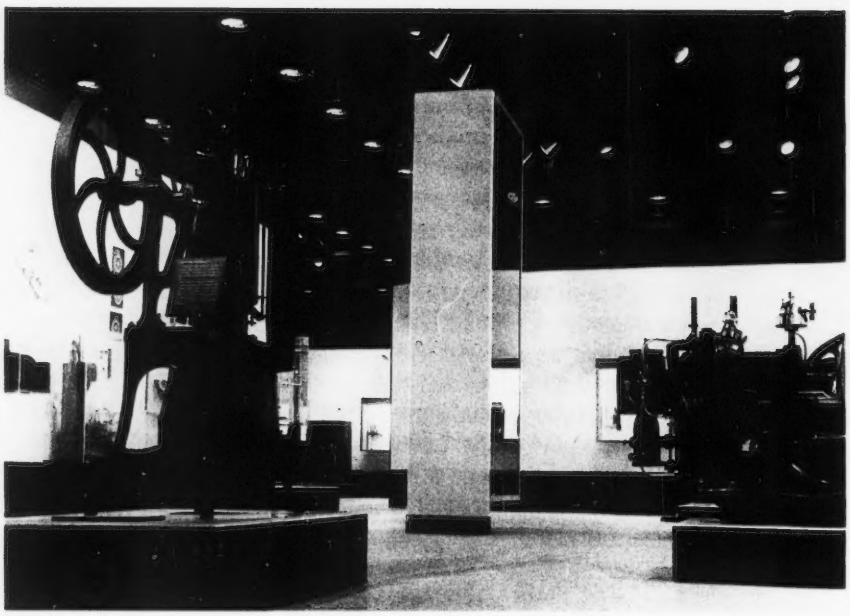


Fig. 2. A section of the Hall of Power Machinery, which illustrates the combined use of plastic cases, free-standing bases, mounted wall cases, and photomurals.

Fig. 3. A general view of the Hall of Power Engineering. The engines seen here have been restored to their original colors of blue, red, gold, and black. When viewed against the black-and-white color scheme of the hall, the effect is quite colorful. The flexible lighting system can be seen overhead. Should future accessions require a shifting of the engines now displayed, the lights can be added, moved, or concentrated as desired.

The Hall of Power Machinery, though not entirely demountable, has adaptability and its exhibits can be moved with a resulting great saving (Figs. 2 and 3).

The Hall of Health was designed by the Museum staff after the new building appropriation was passed, but before much was known of the building interior. For this reason, there is much flexibility in the wall panel system, as it is designed to fit into any given space or ceiling height. The exhibition, "A Study of Man's Knowledge of His Body—Past and Present," was limited in the amount of original specimens available; therefore it was easily adaptable to a panel display system. The system was designed to cover unfinished walls in the old building and to be arranged, if necessary, in a number of patterns against a simple wall in the new building.

The old Hall of Health, one of the earliest displays of this type in the United States, had as a display area 2500 square feet. The new exhibit has a total of 3600 square feet of usable floor. The old ceiling was extremely high and surmounted by a cupola and skylight arrangement that was devastating to our exhibit plan of controlled light. The ceiling was therefore lowered to twelve feet by hung acoustical tile, having directional lighting and circuits for additional flexible lighting fixtures.

All additional units such as the aluminum and wood theatre section, the Fiberglas base for the Transparent Woman, the cement well display units, and free-standing exhibit cases are designed as transportable devices that can be moved with a minimum of difficulty.

Although the ceiling was not designed to be removable, it was considered necessary to supply an essential feature often missing from temporary exhibits—namely a good relation to the space (Figs. 4 and 5).

By the time we had reached the planning stage for the Hall of Textiles, the Museum of History and Technology was well into the preliminary design stages, with the curators and exhibits designers thinking of the new

building first, and of renovation of halls in the old building as opportunities to "store"—on view to the visitor—exhibits built primarily for the new building. This was combined with the policy to avoid any structural changes in existing architecture, and an acceptance of the old Museum shell with all its Victorian intricacy.

The space available for the Textile Hall is some 6000 square feet in one of the long exhibit corridors adjacent to the center rotunda. On one end of the hall a very large stained glass window casts multi-colored patterns on the exhibit floor. Overhead, two vintage aircraft in World War I paint are suspended from white painted roof girders. Around the walls at the sixteen-foot level is a balcony surmounted by a cast iron railing of stout appearance. The condition of all walls and floor in the area is poor.

The curator and designer had the opportunity to design the three Textile Halls for the Museum of History and Technology before settling on a design for the hall in the Arts and Industries Building. The curator wanted very much to give a sampling of all three prospective halls during the time the exhibit was on display in the old building, and to do this, she directed the script toward a unitized display of objects. The designer was then able to work closely with the curator in eliminating areas that could not work under old building conditions and in deciding which machines could best be displayed on open bases and which cases would best represent the three future halls.

A search was conducted for a type of flexible partition system that would appear appropriate to such a large exhibit hall and yet could be cut and arranged in such a manner as to form the nucleus of three exhibit halls in the new building. The Garcy Adapt-a-strut panel and channel system seemed best to cover all our needs. This system, found often in modern department store displays, is amazingly varied, presents a smooth articulated wall upon erection, and accommodates hung or inserted cases with few changes in the standard system. To look well, the panels had to be at least ten feet in height, and to be of reasonable weight they were designed with hollow cores. In order that the panels could be prepared in the exhibits laboratory, they had to be designed for removal and installation by exhibits personnel not trained to install the structural part of the system. The system had to contain its own wiring circuits to substitute for the lack of such circuits in the museum shell. Because all of this was available as standard equipment in the Garcy system, we selected it for use in the Textile Hall.

Much thought was given to the problems of camouflaging the aircraft that hang overhead, and of transforming the stained glass windows into elements of beauty. Nothing seemed to work that could be called portable or even re-usable, and so, with regard to our rules of no structural changes in the old building, the curator and designer decided to live with this

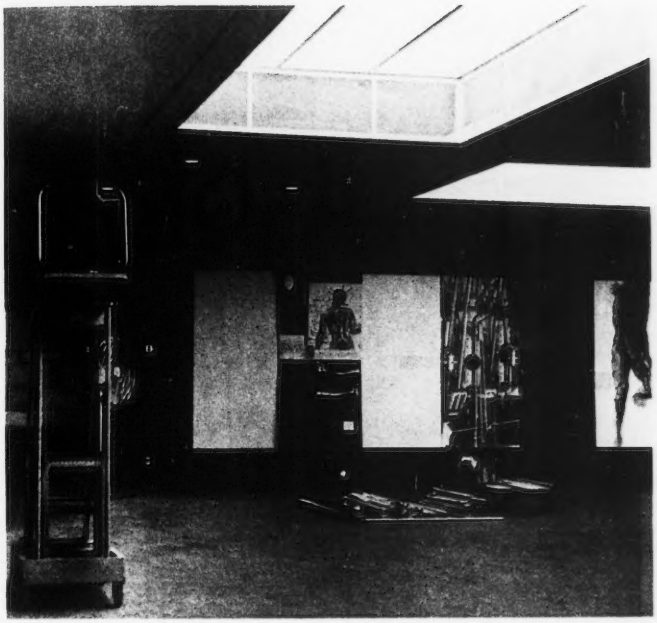


Fig. 4. The Hall of Health wall panels are installed by a leg extension system braced to ceiling and floor.

Fig. 5. The completed Hall of Health. All visible display units are demountable and portable.

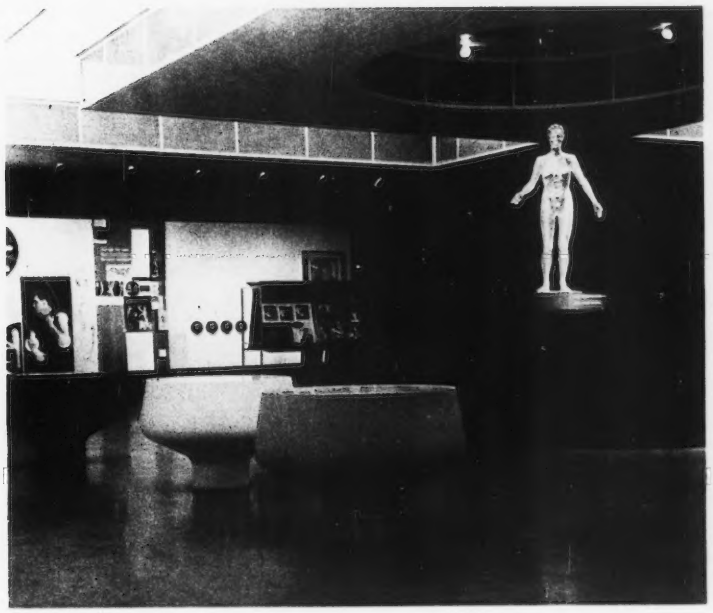


Fig. 6. A view of the conditions existing in the Textile Hall.

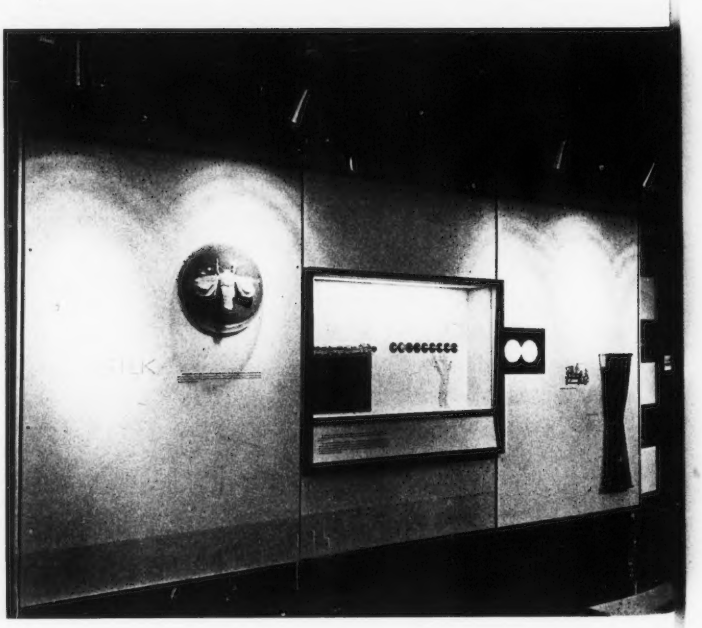


Fig. 7. The test section installed and lighted.

defect in total design. It is hoped that by artful use of lighting on the lower level and by clever exhibits technique in the center floor machine area, the aircraft and the windows will fade to insignificance.

Having the nucleus of three exhibits built in this manner, we will have to construct only the filler portions of the exhibits for the Museum of History and Technology. Most of the difficult planning will be over and a good portion of the time-consuming art work will have been completed. The exhibit will pass into the new building as sections of three new exhibits to be filled out as the space and the story require (Figs. 6 and 7).

The Hall of Graphic Arts will be a 5000 square foot unit in the Museum of History and Technology. The exhibit is to be installed for a limited time in the west wing of the Smithsonian Building. The area selected for the exhibit is a fine example of Gothic architecture, although work which was undertaken years ago to modernize some of the antiquities has resulted in an unfortunate loss of architectural harmony. It is not the purpose at this time to renovate the Smithsonian Building, but it is the purpose of the designer to see that no further damage occurs to the room in the way of built-in cases that might interfere with a future building renovation.

The design for the Hall of Graphic Arts in the Museum of History and Technology covers four basic hand-printing processes and their variations. Each process will be illustrated with a technical panel showing the techniques involved in making the print, and it will be handsomely illustrated by examples from acknowledged masters. The curator requested a close relationship between the panel depicting the techniques of a process and the examples of its fine prints, preferably within the same case. This relationship will be possible to effect in the space planned for the exhibit in the History and Technology Building, but it cannot be carried out fully in the present space in the Smithsonian Building. Because the panels on the technical part of printmaking will absorb most of the time and effort involved in the preparation of the final exhibit, it was decided to prepare these now for the renovation and to leave the mounting of most of the fine prints to a later time.

The Graphic Arts halls in both the Museum of History and Technology and the Smithsonian Building are designed around free-standing center units. This unit, in the Smithsonian Building, will contain twelve technical panels and, in the Museum of History and Technology Building, two or three technical panels with examples of related fine prints. The technical panels in the free-standing unit and the wall cases proposed for the Museum of History and Technology are of equal measurement in height. In the new building, the relationship of technical material to examples of printing can be achieved simply by inserting a long filler panel for the prints. In the new museum, the majority of the technical panels will be displayed in wall cases with the free-standing unit acting largely as a

center-of-room print gallery. In the Smithsonian Building renovation, by planning for the presentation of all technical panels in one large case unit that can be used for fine prints in the expanded exhibit in the new building, we are able to move ahead with the difficult and time-consuming part of the exhibition work and still present what appears to be a fully developed exhibition.

As we approach the opening date of the Museum of History and Technology, the larger areas in the Arts and Industries Building will have been occupied and only the smaller halls will remain. The scheme worked out for the Graphic Arts hall will, by its flexibility, produce useful and reusable exhibits in these limited spaces. How successful we will be in producing exhibitions by this method can only be judged when the new museum is opened six years hence and our work is reviewed critically by millions of visitors.

Toward Well-Being for Museum Visitors

GORDON REEKIE, MANAGER OF EXHIBITION AND CONSTRUCTION
THE AMERICAN MUSEUM OF NATURAL HISTORY

"The ideal museum presents, in logical order, the entire story of the universe, the earth, and its inhabitants, together with their total relation to each other. Practical limitations prevent such a museum from becoming a reality. . . ." From the point of view of operation and maintenance, this is just as well. For it is notoriously true that the level of comfort and ease of viewing in most museums is not of a high order. And the larger and more complex an institution becomes, the greater the problem.

The problem is different for every museum, too. The degree of protection afforded exhibits has a bearing on visitor comfort, as does the nature of the visitor himself. A science museum whose attendance is largely made up of children, for example, cannot embody the niceties of furnishing that should be characteristic of a fashionable art gallery. The difference in approach, however, does not alter the need to answer first a few basic questions of policy: To what extent is it desirable to provide certain facilities for museum visitors, and how practical is it to provide them?

Some early decisions can be made easily on the basis of cost. Few would dispute the desirability of air-conditioning for comfort and cleanliness, but not many institutions can afford complete installations. The car-parking arrangements for visitors to most city museums are either non-existent or inadequate, but adjacent land is either prohibitively expensive or unavailable. Restaurant or cafeteria facilities must be considered on the basis of the likelihood of a profitable financial return. And this can be determined only by the availability of adequate eating facilities outside but near to the institution.

Such big decisions, important as they are, do not relate directly to the well-being of the visitor as he is actually viewing the exhibits. It is axiomatic—though by no means commonly found—that the exhibits themselves should be well displayed, adequately lit, and clearly described. Not so

easily determined is the desirability of encouraging the visitor to linger by means of comfortable seats and living-room temperatures in the exhibition halls. Large urban museums have a particularly difficult problem in this regard. Comfortable accommodation for visitors too often becomes the resting and meeting place for the homeless and the derelict!

It can be laid down as a principle that, so long as no circulation problems—as in a narrow gallery—are created, all exhibition halls should provide some seating accommodation. More important than just offering rest for weary "museum feet," such seating is most desirable for giving the visitor an opportunity for the contemplative look at the hall, the over-all, relaxed viewpoint that is possible only when one is sitting down.

Affecting this decision about seating is the problem of safeguarding the exhibits themselves. The more people there are at any one time in an exhibition hall, the more difficult it is to police the hall and protect the exhibits. A large room which, when normally uncrowded, needs only one guard, may need two or three guards when full of people. And the more comfortable the seating provided, the more it is certain to be used. Further, comfortably seated people in a hall encourage other visitors to linger as they view the exhibits. The sense of well-being soon spreads!

Durability rather than comfort must often be the standard by which this seating is judged, and in institutions visited by large numbers of children, the traditional hard bench may be the only logical answer. However, many of the newer plastic materials simulating cloth and leather have a long life expectancy, and city transit authorities have been surprised at their imperviousness to ill-treatment in bus and subway installations. Even the simple backless bench well-upholstered and covered in such material is surprisingly comfortable to rest on.

Apart from the design of the seat itself, the strongest influence on the museum visitor's decision to stay or leave is the temperature of the halls. No one temperature suits all people, and what is comfortable for a seated person not wearing an overcoat is stifling for a visitor who is wearing one while trying to make a hurried trip through all the exhibits of a large museum. Unless coat-checking facilities are convenient and visitors are encouraged to use them, however, it is wise to slightly underheat the exhibition halls. They are not, after all, living quarters.

Most museums do not permit smoking in their exhibit halls. However, subject to local fire regulations, it is often possible to designate certain spaces as "rest areas," where visitors may sit and smoke in comfort. Such rest areas have been introduced with great success in the Metropolitan Museum of Art in New York, where the vastness of the galleries makes them particularly welcome. Well furnished, and perhaps containing a small exhibit, these rest areas should have a home-like rather than an institutional atmosphere, and should be a far cry from the toilet anteroom

where so many visitors normally snatch their surreptitious cigarette.

Of toilet facilities, water fountains, and the like, it is necessary only to say that there cannot be too many of them.

In the realm of general well-being, more than that of physical comfort, is the difficult question of orienting the new visitor to the whole museum complex when he enters the building. In smaller institutions this is not, of course, a problem, and visitors familiar with specific areas of larger museums find a personal solution to direction-finding by empirical means. However, the plight of the first-time visitor to a large museum—especially a visitor with limited time—is very real. Whether he is anxious to see quickly a representative sampling of all the exhibits, or plans to spend his available time in halls devoted to subjects of special interest to him, it is difficult to make clear the disposition of the exhibits and their relationship to each other. The only completely satisfactory answer is, indeed, a private, conducted tour.

Lacking this ultimate luxury, the large institution should provide information desks near all entrances. And at these desks the visitor should be able to get free floor plans and exhibit listings as well as information. Some institutions provide booklets at a small cost describing what may reasonably be seen of the exhibits in a limited time, and suggesting tours of the exhibits based on related subject matter. Such aids, which are a form of abbreviated guidebook, are excellent, but the first responsibility of the museum to the stranger should be automatically to provide him with some form of free orientation.

Most people find maps and plans hard to follow, and museum visitors are no exception. In all "areas of decision" in a museum, such as foyers, landings, and corridor junctions, large floor plans and exhibit listings should be installed. They should duplicate those pictured in the giveaway folder provided for the visitor, but should be marked with a prominent YOU ARE HERE indicator. The exhibit listings should, of course, be keyed to the halls on the floor plans.

The repeated display of these floor plans and exhibit listings is just the first step in helping the visitor to know at any moment where he is in the museum. They should be reinforced by specific direction signs in any location where confusion or doubt may arise in the visitor's mind. Listings of exhibits by floors, in the style of department stores, can be placed in elevators; the beginning and end of specific exhibition areas should be clearly indicated in the halls themselves, especially where there is no definite architectural dividing line; and care should be taken to insure that there are no contradictions between the various visual aids used to help the visitor. Many a renovated hall in a new location is not matched by the description in the guidebook, and many a visitor has followed the guidebook's directions to a hall now no longer there!

Finally, a word about that most important influence on the visitor's well-being—the museum employee. No matter what ingenuity is expended in making the museum an easy place to explore, most visitors will sooner or later need to ask questions of the attendants, the guards, the information clerks. As the only personal contact the visitor has during his stay, these employees represent the museum in a way that is often remembered for a long time. They are the museum's ambassadors, and should combine the selflessness of the Boy Scout with the knowledge of the Delphic oracle.

CURATOR BOOK REVIEW

A History of Technology, *Volume I, From Early Times to Fall of Ancient Empires. Charles Singer, E. J. Holmyard, and A. R. Hall. London, Oxford University Press, 1956, 827 pp., illus., $25*

A History of Technology, *Volume II, The Mediterranean Civilizations and the Middle Ages. Charles Singer, E. J. Holmyard, A. R. Hall, and Trevor I. Williams. London, Oxford University Press, 1956, 802 pp., illus., $25*

There are few published works today to which the description of *magnum opus* can be applied, but "A History of Technology" is one of them. The series will be completed in five volumes, two of which have already been published, and will cover the subject from the Old Stone Age to the end of the nineteenth century. The language is crystal clear, with few specialist terms, and proves, as Professor I. Bernard Cohen says, ". . . that the knowledge and insight of specialists can be made available to the general reader with dignity and without loss of critical standards."

The preparation of the series was made possible through an endowment from Imperial Chemical Industries—a happy marriage between science and enlightened industry making a corporate contribution to technical education. The editors aimed not at providing an up-to-date history of applied science, but at affording a long perspective of the ways in which the immensely complex technical knowledge of our civilization has come into being, and how deep its roots are buried in very ancient processes known to many civilizations.

Volume I begins with man's first tool—called "language"—then expands to a study of his first "civilizations." Because the series was planned as a course of study, it was written for continuous reading. The editors modestly assert that their work is a tentative effort, and omit from their survey such subjects as the development of medicine, of architecture, and of certain other arts, since they have been adequately treated in other accessible works.

The first volume covers basic social factors—human skill, early forms of society, time-reckoning, food-collecting, early chemistry, cooking, cosmetics, primitive housing, domestication of animals, textiles, basketry, water supply, irrigation, agriculture, metals, woodworking, transportation, and the preparation for coming science in recording and writing, measures and weights, and ancient mathematics and astronomy.

Volume II deals with the classical civilizations of the Mediterranean and the cultures that arose in barbarian Europe. The basic technologies described in the first volume are related to mining and quarrying, metallurgy, farm tools, food and drink, leather, spinning and weaving, the making and styling of furniture, ceramics, glass and glazes, pre-scientific industrial chemistry, the medieval artisan, building construction, roads and land travel (with a section on harbors, docks, and lighthouses), vehicles and harness, shipbuilding, power and machines, hydraulic engineering, alchemical equipment, and an epilogue, "East and West in Retrospect," that sums up what has been covered thus far.

Although Volume I was published in 1954 and Volume II in 1956, this review was written with the purpose of acquainting those who may have missed their issuance with one of the most significant and useful publications to appear in many years. The cost of each volume is high, but no museum, whether it be of art, science, history, industry, or related museum fields, can afford to be without this compilation of findings and writings that mark man's activities over a period of half a million years.

W. A. B.

NATURAL HISTORY MANUSCRIPTS

The editorial staff of NATURAL HISTORY invites interested scientists to consider its pages as an appropriate medium for the presentation of articles of a general nature in the following fields: the biological sciences, the earth sciences, astronomy, and anthropology. Scientists whose work includes use of the camera as a research tool may find that NATURAL HISTORY's editorial policy of extensive illustration provides them an opportunity to publish substantial numbers of photographs. Those whose work requires other kinds of illustrations will find the editorial staff eager to assist in developing appropriate treatments. Articles may treat with specifics (cf. the Meyerriecks' report on the species status of the Great Blue Heron, January 1958); may be a part of a "series" treatment of a general subject (cf. Hutchins on an example of symbiosis, November 1957); or may address themselves to such broad themes as scientific methodology (cf. Aronson and Shaw, October 1957) or the history of science. Suggestions, in advance of manuscript drafting, are particularly welcome and will receive prompt replies. Please address: NATURAL HISTORY, 79th Street and Central Park West, New York 24, N.Y.

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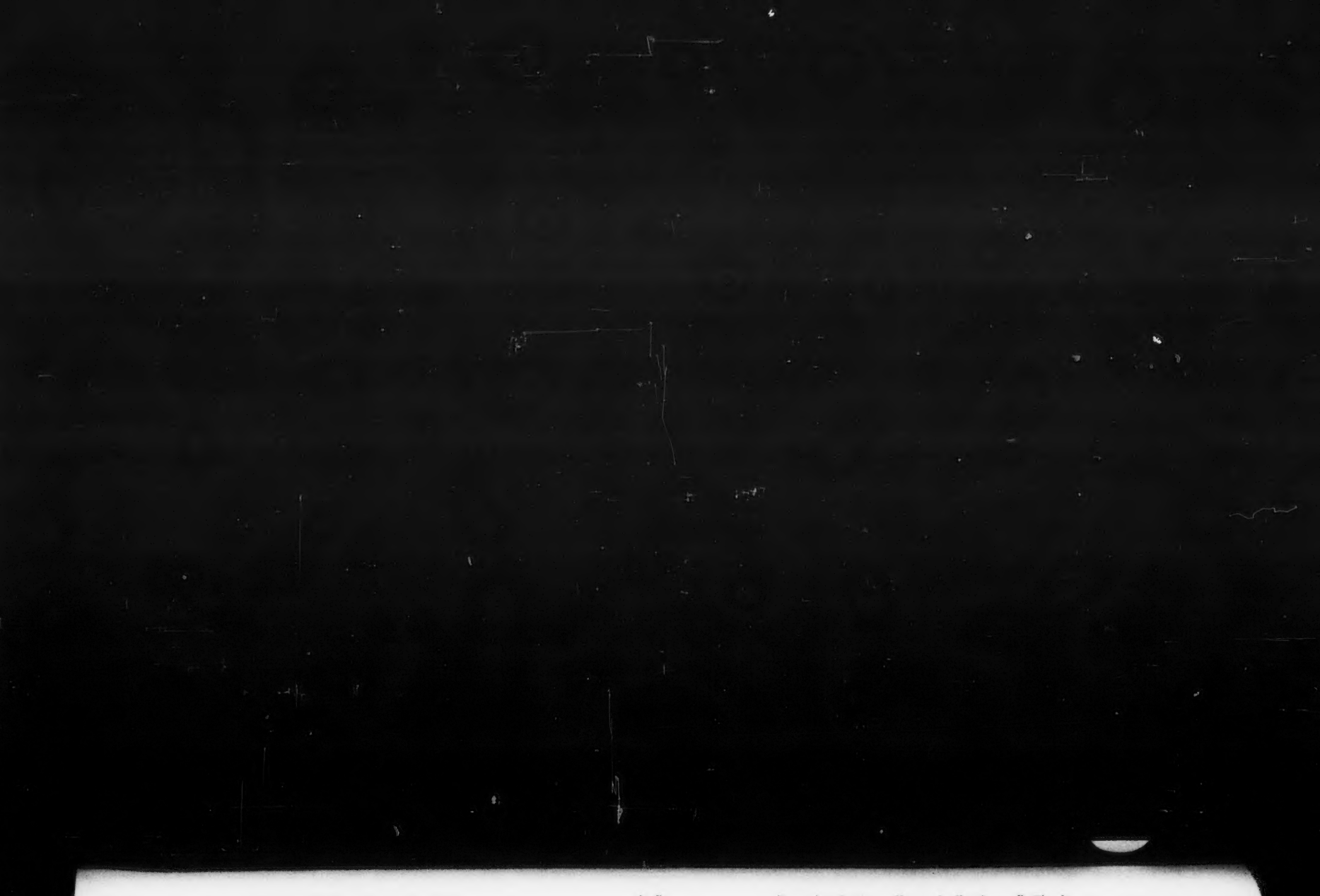
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